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# Apple Technician Guide



## MacBook (13-inch, Aluminum, Late 2008)

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# MacBook (13-inch, Aluminum, Late 2008)

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# Manual Updates

## Updated 15 June 2010

### Troubleshooting:

- General Troubleshooting: Resetting the System Management Controller (SMC): Updated text to clarify MagSafe LED behavior; deleted text requiring resetting date and time.

## Updated 14 May 2010

### Basics:

- General Information: Keycap Replacement: Added section about new keycap replacement kit

### Troubleshooting:

- Symptom Charts: Startup and Power Issues: Intermittent Shutdown: Revised section
- Symptom Charts: Input/Output Devices: Built-In Keyboard Does Not Work Properly: Revised step 1 of Deep Dive table for keycap kit reference
- Symptom Charts: Input/Output Devices: Specific Keys Don't Work Properly: Revised step 5 of Quick Check table for keycap kit reference

## Updated 16 November 2009

### Take Apart:

- General Information: Connector Types: Added replacement note about installing foam gasket on LVDS connector.
- Display Assembly: Added replacement note about installing foam gasket.
- Logic Board: Added replacement note about installing foam gasket.

## Updated 21 August 2009

### Troubleshooting:

- General Troubleshooting: Troubleshooting Theory: Updated link information

### Take Apart:

- Display Assembly: Added reminder about correct position of AirPort cable when reconnecting to AirPort Card



## Updated 19 June 2009

### Troubleshooting:

- Startup and Power Issues: Modified Noise/Hum/Vibration Deep Dive table, steps 7-8
- Display: Modified Noise/Unstable Flickering Deep Dive table, steps 3-6

## Updated 9 June 2009

### Troubleshooting:

- Display/Display Anomalies: Added “Deep Dive: Vertical/Horizontal Lines” table
- Built-in Trackpad Does Not Work: Modified Deep Dive table for trackpad replacement
- Built-in Trackpad Does Not Track Properly: Modified Deep Dive table for trackpad replacement

### Take Apart:

- Added Trackpad replacement instructions
- Memory: Corrected memory card pin count from 200-pin to 204-pin
- Logic Board: Added reminder to **not** remove MagSafe screws during logic board service

### Views:

- Exploded Views: Added Trackpad part to Main Assembly, 2 of 2

## Updated 24 March 2009

**Important:** When ordering parts, please replace like-for-like. Refer to the exploded view, screw chart, and the Global Service Exchange (GSX) parts ordering system to further identify part replacement by configuration code.

### Views:

- Added part numbers to Main Assembly and Display Assembly exploded views
- Added 5 alternate part numbers to Screw Chart

## Updated 10 March 2009

### Troubleshooting:

- Updated Knowledge Base article link for Liquid Submersion Indicators.
- Added “Display Issue: Pixel Anomalies” topic
- Intermittent Shutdown: Added new table “Troubleshooting Shutdown Causes”

### Take Apart:

- Connector Types: Added keyboard cable image and caution
- AirPort Card: Reworded step 2 under “Replacement”
- Logic Board: Added step for bottom case clip and 2 screws; added step to show MagSafe cable routing
- MagSafe Board: Added port test using **unplugged** power adapter cable



## Updated 16 December 2008

### Basics:

- Product Configurations: Corrected “Better” model number to MB466
- Required Tools: Added EMI-safe tweezers to tools list; added ASD and AHT version numbers

### General Troubleshooting:

- Functional Overview: Updated heatsink thermal sensor box; updated memory startup tones
- Block Diagram: Updated memory to DDR3 and Bluetooth to 2.1
- Apple Service Diagnostics: Added new heading and error code sensor chart

### Symptom Charts:

- Added step 6 to “Won’t Start Up” quick check chart
- Updated step 6 of “Intermittent Shutdown” deep dive chart
- Updated “No Video/Bad Video” deep dive chart
- Updated “Defective Camera” charts
- Added Unlikely causes to Blank/No Video chart
- Added Unlikely causes to Backlight Issue/No Backlight chart; added symptoms to quick check chart
- Added Unlikely causes to Noise/Unstable Flickering chart
- Updated “Built-In Keyboard Does Not Work Properly” charts
- Updated “Specific Keys Don’t Work” quick check chart; added Unlikely causes
- Updated “Built-In Keyboard Has Dim or No Keyboard Backlight” deep dive chart

### Take Apart:

- Connector Types on Logic Board: Added tweezers for Locking Lever flex cable
- Battery: Added note to seat battery connector
- Hard Drive: Replaced steps 4-6 of Installing Mac OS X and Applications
- Display Assembly: Added Important Note reminding technician to install a new thermal pad on the AirPort Card whenever the display assembly is removed and replaced
- AirPort Card: Updated image in replacement step 1; noted using black stick
- Optical Drive: Revised step 3 to disconnect cable
- Fan: Added black stick to release fan connector
- Logic Board: Added tweezers for locking-lever flex cables
- Hard Drive Front Bracket with IR/Sleep Cable: Added tweezers for locking-lever flex cables

### Views:

- Exploded View: Display Assembly: Added international AirPort Card part numbers

## Updated 17 November 2008

- Take Apart: Added [important replacement step in AirPort Card](#) topic alerting technicians to check that the AirPort cable is inserted properly into the AirPort Card connector. If the cable is inserted backwards, it will damage the logic board.
- Troubleshooting: Updated steps in the [Burnt Smell/Odor symptom](#). Added step 3 to the Quick Check table as a reminder to verify AirPort cable connection.



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## **Updated 19 October 2008**

Corrected internal links.

## **Updated 17 October 2008**

- Corrected internal links.
- Take Apart: Reorganized topic sequence following Display Assembly.
- Exploded View: Display Assembly: Corrected display assembly part number to 661-4820.

## **Manual introduced 14 October 2008**



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# **Apple Technician Guide**

## **Basics**

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### **MacBook (13-inch, Aluminum, Late 2008)**



# Overview



The MacBook (13-inch, Aluminum, Late 2008) computer features a powerful new NVIDIA GeForce 9400M graphics processor, Multi-Touch trackpad, and aluminum body. Refer to more features below.

## Identifying Features

The main features and service differences include:

- Aluminum case
- Glass backlit, glossy, widescreen display panel
- Mini DisplayPort connector
- Battery indicator button on left side
- Illustrations for removing the battery, hard drive, and memory cards are pictured on the inner side of the access door.
- Product identification label is on top case front edge, visible when the access door and battery are removed.
- Logic board, MagSafe board, and some other components have a uniform black color with no component silkscreening.



## Product Configurations

The following table shows the MacBook (13-inch, Aluminum, Late 2008) model configurations at introduction:

Feature	Better (MB466)	Best (MB467)
Intel Core 2 Duo processor	2.0 GHz	2.4 GHz
Memory, DDR3 1066, SO-DIMMs	2 GB (2 x 1 GB); up to 4 GB (2 x 2 GB)	2 GB (2 x 1 GB); up to 4 GB (2 x 2 GB)
Hard Drive, Serial ATA 100 5400 rpm	160 GB; up to 320 GB	250 GB; up to 320 GB
Optical Drive (SATA)	8x DL Super, 9.5 mm	8x DL Super, 9.5 mm
Keyboard	Standard	Backlight
Housing	Aluminum	Aluminum
Display	13.3-inch glass LCD, 1280x800, 114 dpi, LED backlight, glossy finish	
Battery	45-Whr Lithium Ion	
Power Adapter	60 W MagSafe	

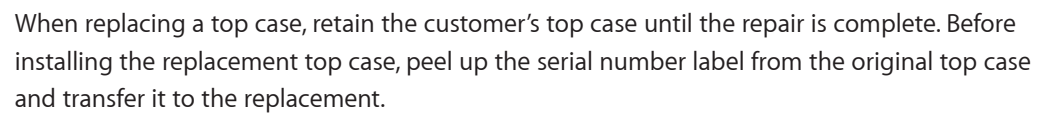
## Note About Images in This Manual

Because a pre-production model was used for most of the images shown in this manual, you may notice small differences in appearance between the image pictured and the computer you are servicing. However, although the appearance may differ, the steps and sequence are the same unless noted.

Screw sizes shown are approximate and indicate the total length including the screw head.



Remove the access door and battery to see the serial number on the inside front wall of the top case.





# General Information

## Required Tools

**Caution:** To prevent scratches or other cosmetic damage to the computer housing, use a soft cloth as a protective layer when removing and installing the external screws.

The following tools are required to service the computer:

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetic Phillips #0 screwdriver
- Magnetic Phillips #00 screwdriver (preferably with a long handle)
- Torx T6 screwdriver
- Black stick (Apple probe tool, part number 922-5065) or other nonconductive nylon or plastic flatblade tool
- Tri-lobe Large #0 driver (Apple part number 922-8991) for trackpad replacement
- Tri-lobe Small #00 driver (Apple part number 922-9013) for trackpad replacement
- Torx T5 screwdriver from regional supply vendor for trackpad replacement
- EMI-safe plastic or nylon tweezers for installing flex cables (optional)
- Thermal grease (Apple thermal compound syringe, part number 922-7144)
- Alcohol wipes
- Permanent marking, felt-tip pen (optional)
- Pencil with eraser
- Foam wedge fixture for display assembly removal (Apple part number 922-8779)
- Kapton tape
- Digital volt meter (troubleshooting)

Refer to Knowledge Base article “Hand Tools for Desktop and Portable Repairs--AP/CA/EU/JP/LA/US” to purchase tools:

<http://docs.info.apple.com/article.html?artnum=500200>

In addition, the following software programs are required for troubleshooting:

- Apple Service Diagnostic (ASD), version 3S125 or later
- Apple Hardware Test, version 3A148 or later



## The Glass Panel

**Warning:** The glass panel for this model is not a serviceable part. If the glass is broken or scratched, replace the display assembly. Attempting to remove the glass can permanently shatter the display face and damage other parts.

To clean the glass panel, use the Apple polishing cloth (922-8245) and iKlear Apple Polish or Brilliance anti-static spray cleaning solution. Alternatively, IPA (isopropyl alcohol) can be used.



## Keycap Replacement

Service packages of 78 replacement keycaps are now available in the U.S. and Canada (U.S. version keyboard only) for designated MacBook and MacBook Pro computers. The packages allow you to replace individual keycaps rather than the entire top case.

There are four different keycap packages, based on the color of the key and the type of keyboard (version D and S).

Part number	Key color	Keyboard
922-9277	Black	Version D
922-9279	Black	Version S
922-9278	White	Version D
922-9280	White	Version S

For step-by-step instructions, refer to the relevant support article: [“MacBook/MacBook Pro: Black Keycap Replacement” \(HT4002\)](#) or [“MacBook: White Keycap Replacement” \(HT4003\)](#).

For an overview of the differences among keycap procedures, refer to [“MacBook/MacBook Pro: Keycap Replacement Matrix” \(HT4001\)](#).

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# **Apple Technician Guide**

## **Troubleshooting**

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### **MacBook (13-inch, Aluminum, Late 2008)**



# General Troubleshooting



## Update System Software

**Important:** Whenever possible before beginning troubleshooting, ensure the latest software and firmware updates have been applied.

## Troubleshooting Theory

For general information on troubleshooting theory, go to GSX and find the Service Training course menu link. From there you can access the Troubleshooting Theory self-paced course.

## Hardware vs. Software

For information on how to isolate a hardware issue from a software issue, refer to:

[http://support.apple.com/kb/TS1388?viewlocale=en\\_US](http://support.apple.com/kb/TS1388?viewlocale=en_US)

TS1394—Mac OS X: Troubleshooting installation and software updates <<http://support.apple.com/kb/TS1394>>

HT2956—Troubleshooting Mac OS X installation from CD or DVD <<http://support.apple.com/kb/HT2956>>

For information on how to troubleshoot a software issue, refer to:

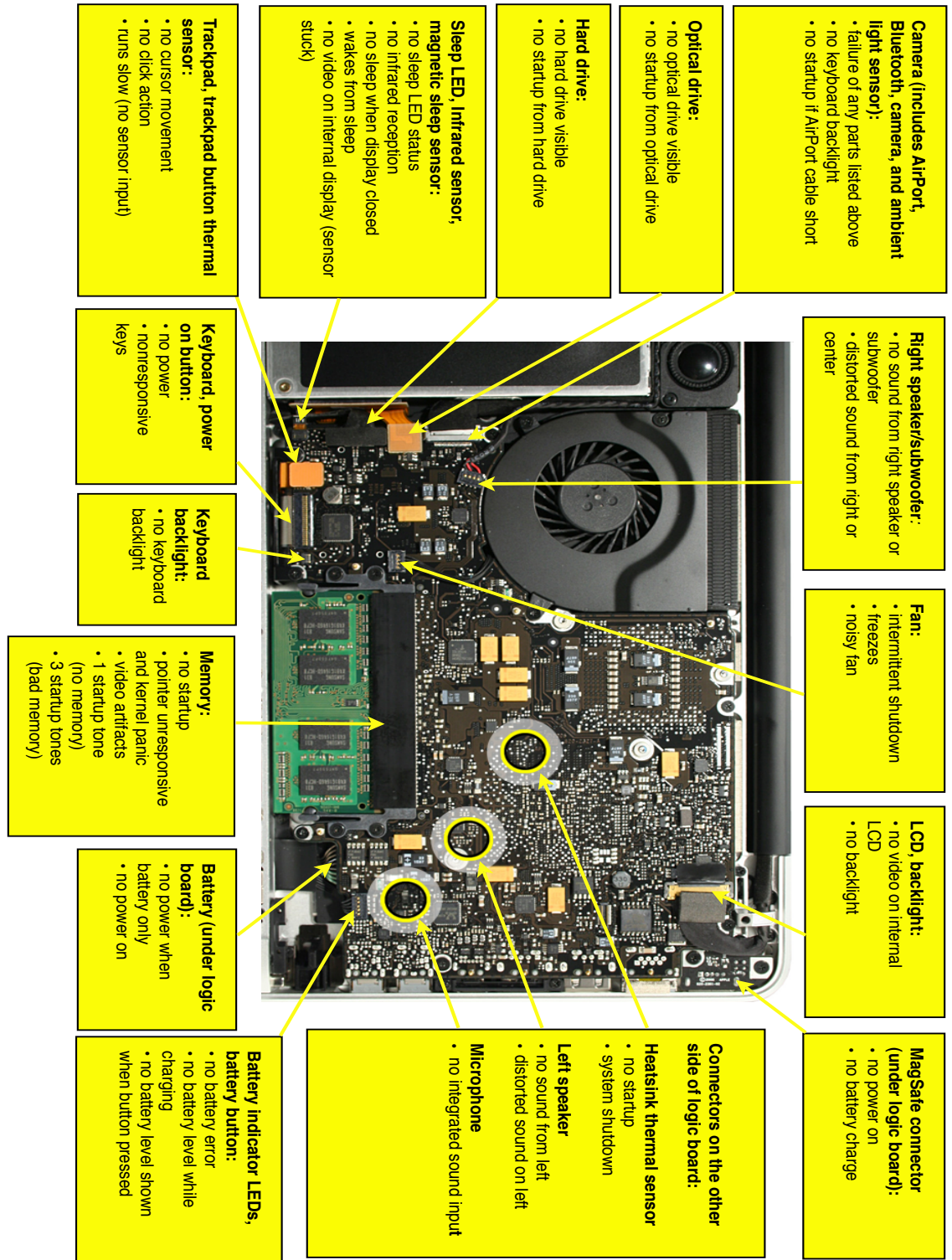
HT1199—Mac OS X: How to troubleshoot a software issue <<http://support.apple.com/kb/HT1199>>





## Functional Overview

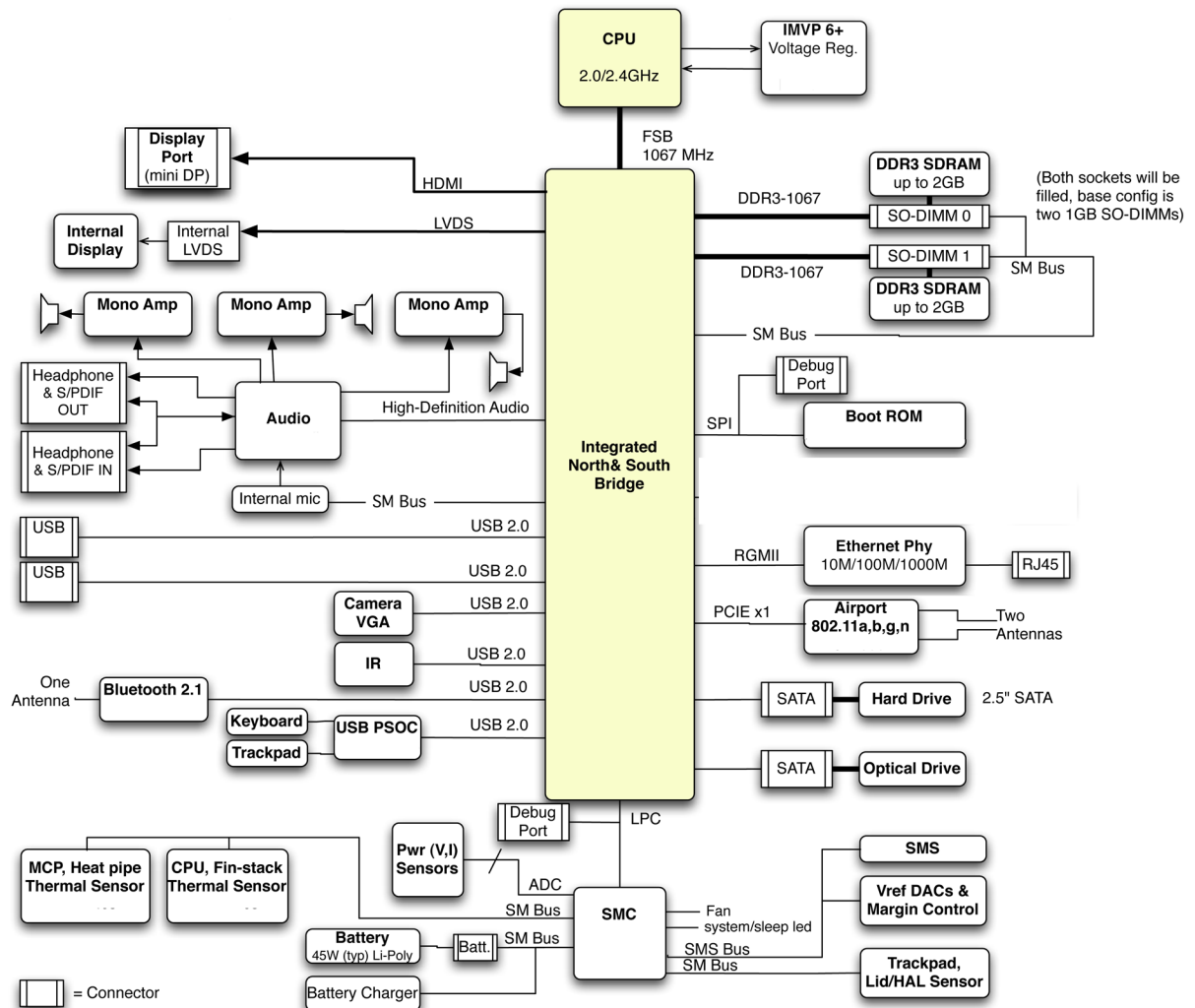
Refer to this diagram for symptoms related to logic board connectors.





## Block Diagram

Refer to this diagram to see how modules are interrelated.

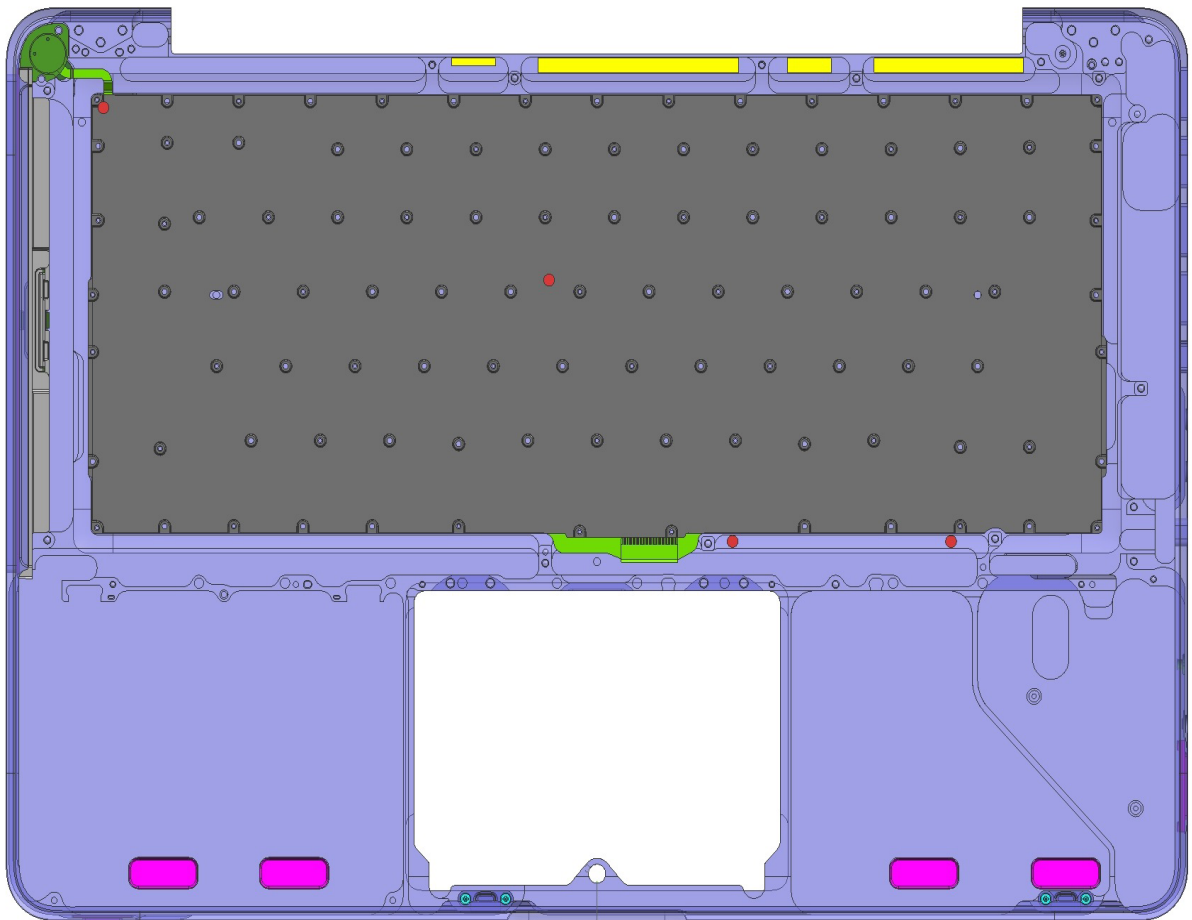




## Liquid Submersion Indicators

To help discover accidental damage to the computer, the top case includes spill sensors called liquid submersion indicators (LSI). The sensors are only visible when the bottom case and most of the modules have been removed. Normally represented by small white dots, the LSIs turn red (indicated by the four small, round dots shown below) when they have come in contact with liquid, such as an accidental spill.

For more information, refer to the Knowledge Base article [HT3425: "About liquid submersion indicators \(LSI\) on portable and desktop computers."](#)





## Common Reset Procedures

When a reset procedure is required for troubleshooting, follow the applicable steps:

### Resetting the System Management Controller (SMC)

To reset power management via the SMC chip:

1. If the computer is on, turn it off by choosing Shutdown from the Apple () menu.
2. Connect the power adapter to the computer and to a working power source.
3. **Important:** Use the keys on the left side of the keyboard. On the built-in keyboard, press Shift-Control-Option along with the power button once.

**Note:** When the LED on the MagSafe connector is orange, resetting the SMC will change it to green for a few seconds, indicating that SMC was correctly reset.

4. Wait 5 seconds and press the power button to restart the computer. **Note:** If bottom case is removed, you may alternately reset the SMC by disconnecting the power adapter and the main battery, and holding the power button down for five seconds.

For more information:

<http://www.apple.com/support>

HT1411 — Apple Portables: Resetting the System Management Controller (SMC) <<http://support.apple.com/kb/HT1411>>

### Resetting the Parameter RAM (PRAM)

To reset PRAM,

1. If the computer is on, turn it off.
2. Locate the following keys on the keyboard: Command, Option, P, and R. You will need to hold these keys down simultaneously in Step 4.

**Note:** If the keyboard does not have an Option key, use the Alt key instead.

3. Turn on the computer.
4. Press and hold the Command-Option-P-R keys.

**Important:** You must press this key combination before the gray screen appears.

5. Hold the keys down until the computer restarts and you hear the startup sound for the second time.
6. Release the keys.

For more information:

<http://www.apple.com/support>

HT1379 — Apple Portables: Resetting the PRAM <<http://support.apple.com/kb/HT1379>>



## Starting Up in Safe Mode

A Safe Boot is a special way to start Mac OS X when troubleshooting. To start up into Safe Mode (Safe Boot),

1. Make sure the computer is shut down.
2. Press the power button.
3. Immediately after you hear the startup tone, press and hold the Shift key.  
**Note:** The Shift key should be held as soon as possible after the startup tone but not before.
4. Release the Shift key when you see the screen with the gray Apple and progress indicator (looks like a spinning gear). During startup, "Safe Boot" appears on the Mac OS X startup screen. To leave Safe Mode, restart the computer normally, without holding down any keys during startup.

For more information:

<http://www.apple.com/support>

HT1564—What is Safe Boot, Safe Mode? <<http://support.apple.com/kb/HT1564>>

TS1884—Safe Boot take longer than normal startup <<http://support.apple.com/kb/TS1884>>

## Apple Service Diagnostics

Run Apple Service Diagnostics to determine if any of the thermal sensors are malfunctioning. Replace any failing sensors. See chart below for correlation between error code and part.

Name	Location
TC0D	Logic board
TC0P	Logic board
Th1H	Logic board
TN0D	Logic board
Th0H	Heatsink
Ts0P	Trackpad flex cable
TB0T	Battery
TB1T	Battery
TB2T	Battery
TB3T	Battery



## Clamshell Service Diagnostic Read Me

Isolating video and wireless issues in portable computers can be time consuming and confusing. The Clamshell Service Diagnostic (CSD) is a new diagnostic tool that checks Apple's latest portable computers for the presence of AirPort, Bluetooth, LCD and Ambient Light Sensor (ALS) to assist you in quickly making a failure determination.

Troubleshooting benefits of using CSD include:

- Quick way (less than 1 minute) to determine whether clamshell-related modules (AirPort, Bluetooth, LCD and ALS) are electrically connected without taking apart the system.
- Results of CSD can help pinpoint if any clamshell cables may need to be reseated to logic board.
- Diagnostic results can help isolate a video or wireless issue to either the clamshell or the logic board, to avoid unnecessary replacements of these components.

CSD checks for the presence of the computer's:

- AirPort
- Bluetooth
- LCD
- ALS

CSD does not check for the presence of the computer's:

- iSight camera
- externally connected hardware components (such as USB or FireWire devices)

CSD does not check for issues with the OS X or other software-related problems such as application or extension conflicts.

## Display Issue: Pixel Anomalies

When displaying a single color over the screen area, the LCD panel might show one or more pixels that are not properly lit. To determine if the display has an acceptable number of pixel anomalies, follow the steps below:

1. Set the display image to one of the following colors: all-white, all-red, all-green, all-blue, or all-black display. Knowledge Base article [112125: Service Diagnostics Matrix](#) has the LCD Tester Diagnostic Utility that will generate these patterns on the screen.
2. Using a jeweler's loupe, pocket microscope, or other magnifying device, identify and count each pixel anomaly:

Bright subpixel anomaly = subpixel that is always on

Dark subpixel anomaly = subpixel that is always off

3. The number of acceptable pixel anomalies for this computer is:

Bright	Up to 3
Dark	Up to 5
Combination	Up to 7



4. If the number of subpixel anomalies exceeds the acceptable number shown above, replace the LCD panel display assembly. Numbers outside the acceptable range would be

Bright	4 or more
Dark	6 or more
Combination	8 or more

5. If the number of subpixel anomalies is acceptable, explain to the customer that the pixel anomalies are within specifications, and no repair is necessary.

**Important:** Do not release the specifications to customers. Instead, inform them that a certain number of subpixel anomalies are considered acceptable, and these factors apply to all manufacturers using LCD technology—not just Apple products.

When speaking with customers, please use the following explanation:

Active-matrix LCD technology uses rows and columns of addressable locations (pixels) that render text and images on screen. Each pixel location has three separate subpixels (red, green, and blue) that allow the image to be rendered in full color. Each subpixel has a corresponding transistor responsible for turning the subpixel on or off.

There are typically millions of these subpixels on an LCD display. For example, the LCD panel used in the Apple Cinema HD display is made up of 2.3 million pixels and 6.9 million red, green, and blue subpixels. Occasionally, a transistor does not work perfectly, which may result in the affected subpixel being turned on (bright) or turned off (dark). With the millions of subpixels on a display, it is quite possible to have a low number of faulty transistors on an LCD. Therefore, a certain number of subpixel anomalies are considered acceptable. Rejecting all but perfect LCD panels would significantly increase the retail price for products using LCD displays. These factors apply to all manufacturers using LCD technology—not just Apple products.



# Symptom Charts

Follow the steps in the order indicated below. If an action resolves the issue, retest the system to verify.

Note: A compilation of Quick Check tables is available at <http://service.info.apple.com/QRS/en/quickreference.pdf>

## Startup and Power Issues

### No Power

Unlikely cause: display assembly, speakers, optical drive, hard drive

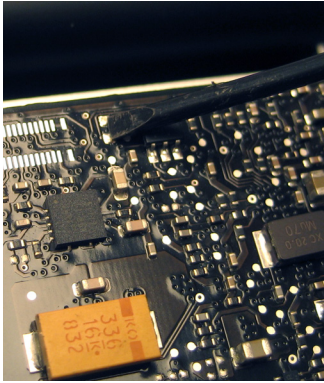
#### Quick Check

Symptom	Quick Check
<b>No Power / Dead Unit</b> <ul style="list-style-type: none"><li>No power</li><li>No image</li><li>No startup chime</li><li>No fan or hard drive spin</li><li>No reset sound from optical drive</li><li>No sleep LED activity</li><li>No light if Caps Lock pressed</li><li>Non-operational</li></ul>	<ol style="list-style-type: none"><li>1. Verify AC power presence with MagSafe LED indicating on or charge state.</li><li>2. Verify battery status as being partly charged, charging with AC power.</li><li>3. If battery is not recognized, remove battery and try to run from AC only.</li><li>4. Reset SMC.</li><li>5. Verify with known-good battery.</li></ol>

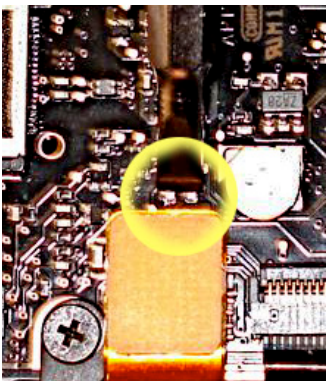
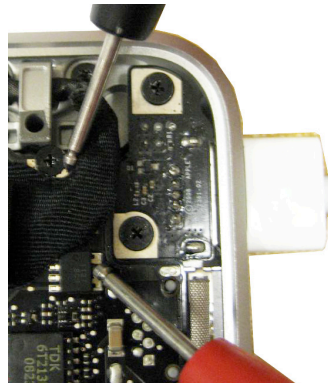
#### Deep Dive

Check	Result	Action	Code
1. Isolate peripherals as cause. Disconnect all peripherals and external devices and verify unit starts.	Yes	Suspect peripherals as cause. Reconnect each one at a time, verifying unit operation as external device is reinstalled.	
	No	Go to step 2	





2. Reset SMC., and verify unit starts. (Alternative hardware SMC reset can be forced by shorting R5001 pads on logic board or removing all system power for 1 minute.) Can system start up after SMC reset?	Yes	Corrupt SMC state preventing power on. Issue resolved with SMC reset.	
	No	Go to step 3	
3. Will system power up with battery only? Check battery level LED indicator for status of battery charge or battery use error. Inspect battery connector for burn marks or damaged pins if substituting a known-good battery to verify starting on battery.	Yes	System can start up from known-good battery -- customer battery possibly at fault or needs to be charged. Continue to verify customer battery then AC adapter use and battery charging. Go to step 4.	<b>P11</b>
	No	System will not power using known-good battery only. Go to step 5	
4. Customer battery may be run down, or not recognized. Verify customer battery in a known-good system is recognized and accepting a charge. Confirm customer battery is not consumed nor defective.	Yes	Battery is recognized, charging and health is good. Return to test unit with customer battery and AC adapter power. Go to step 6.	
	No	Replace customer battery for not charging (P10) or not recognized (P11). Customer to purchase a replacement battery if consumed.	<b>P10 or P11</b>
5. Inspect battery cable connection at logic board and reseal if necessary. Replace cable if found damage or burned. Can the system power on from a charged battery with battery cable inspections or replacement?	Yes	Battery power restored, return to test unit with customer battery and AC adapter power. Go to step 6.	
	No	Logic board is expected to power on with battery only. Inspect and test power on key. Go to step 10.	
6. Inspect MagSafe power adapter. Verify AC adapter is correct wattage, compatible with product and works on known-good computer.	Yes	Power adapter is good, go to step 7	
	No	Release stuck pin or replace adapter due to wire damage, not working or burned pins	<b>P14</b>



7. Inspect MagSafe port on computer for physical damage, debris or metal fragments attracted to magnetic connector. Is MagSafe connector clean and free from defects?	Yes	Go to step 8	
	No	Clean port assembly. Replace MagSafe board if necessary.	<b>X03</b>
8. Verify adapter status LED turns on green then orange indicating power and battery charge in progress. A green LED can indicate a full battery, removal of battery or battery not recognized.	Yes	System starts and has power. MagSafe LED indicates power is flowing to logic board. Verify customer battery will also charge. Review battery health to ensure customer satisfaction.	<b>P11</b>
	No	AC power is down or battery is not charging. Go to step 9	
9. Verify power from adapter is present on logic board. Remove system battery, use AC power only. With DVM, verify voltage presence of Q7001, pin 5 is 16.7Vdc with AC adapter connected. Reseat or test known-good MagSafe cable to achieve power for logic board.	Yes	Logic board has power adapter energy to start system, 16.7V found on Q7001. MagSafe cable reseat or replacement resolved issue. If still no system power on indications, go to step 10	<b>X03</b>
	No	No voltage measured on Q7001, AC adapter power not going to logic board power supplies. Replace logic board.	<b>M21</b>
10. Test and inspect Top Case Power Button. Stuck or open power on key or keyboard disconnect can disable the power on of system. If button does not work, locate R5015 pads on logic board just above trackpad connector, and short pads to power up logic board. If power on key is stuck, keyboard cable must be disconnected for R5015 to work. Does system power on? (Reconnect keyboard cable to confirm bad or intermittent connections.)	Yes	Power on key works fine, issue resolved.	
		Power on key works when keyboard cable is resealed.	
		Power on key appears to be stuck, had to remove keyboard cable for R5015 power on. Replace top case for stuck power on key	<b>K05</b>
	No	No logic board power on when shorting R5015 pads. Replace logic board.	<b>M01</b>



## Won't Start Up

Unlikely cause: display assembly, speakers, fan, camera, microphone

### Quick Check

Symptom	Quick Check
<b>Power but No start up</b> <ul style="list-style-type: none"><li>No startup chime, some video activity, Apple logo, startup spin dial</li><li>Startup chime with possible beep tones.</li><li>Fan, hard drive spin or optical drive reset sound</li><li>Sleep LED is on , blinking or went out</li><li>Caps Lock LED toggles when pressed</li></ul>	<ol style="list-style-type: none"><li>Reset SMC.</li><li>Verify startup process passes initial memory checks – no beep errors or flashing sleep LED indicators. Display activity is starting up.</li><li>Clear PRAM. Verify starts up from user drive.</li><li>Connect known-good external bootable device and press Alt key during startup then select external startup device to bring up system for diagnostics.</li><li>Verify presence and status of user hard drive. Use Disk Utility to repair drive and file permissions.</li><li>Start up in Safe Mode by pressing power button and holding down Shift key when you hear startup tone.</li></ol>

### Deep Dive

Check	Result	Action	Code
1. Reset SMC and Clear PRAM to set default startup device to internal hard disk drive (HDD).	Yes	User hard drive bootable, issue resolved default settings.	
	No	Customer system not starting up, go to step 2	
2. Is system indicating a memory error with repeated sleep LED 1 or 3 flash sequence and beep tones if sound is enabled?	Yes	Troubleshoot memory issues, go to step 3	
	No	Continue with startup sequence verification go to step 4	



3. Reseat customer memory and/or swap in known-good memory to isolate bad memory and replace defective parts.	Yes	Customer memory defective and replaced. Continue to verify startup process. Go to step 4	<b>X02</b>
	No	Should known-good memory fail in one or more slots, replace logic board.	<b>M07</b>
4. Hold the Alt (Option) key during startup and verify there is a bootable hard drive shown in Startup Manager. Choose customer hard drive. Does start up from this drive work?	Yes	System starting up from customer hard drive. Startup issue resolved	
	No	Customer hard drive not present or does not start up from this drive. Continue to find bootable device. Go to step 5	
5. Insert product OS install disc in optical drive. Install disc is bootable and should be present in Startup Manager. Can system start up from OS install disc?	Yes	Starts up from optical drive - customer hard drive not yet bootable, go to step 8	
	No	Computer has no internal bootable devices. Test external startup devices, go to step 6	
6. Boot from a known-good bootable copy of product OS on a USB drive or network server to start up and verify internal mass storage devices are available using System Profiler and Disk Utility.	Yes	System started up from external device and reports data regarding internal SATA devices. Go to step 7	
	No	No startup devices available. Replace logic board	<b>M02</b>
7. Troubleshoot optical drive and optical drive cable with cable reseat and known-good part substitutions. Is there a defective optical drive component to replace?	Yes	Cable reseat solved issue. Continue to verify hard drive issues, go to step 8	
		Defective optical drive cable found and replaced. Continue to verify hard drive issues, go to step 8	<b>X03</b>
		Defective optical drive found and replaced. Continue to verify hard drive issues, go to step 8	<b>J03</b>
	No	Replace logic board	<b>M19</b>



8. Use Disk Utility loaded from OS install disc to verify if hard drive is available on device list. Is customer hard drive listed in Disk Utility?	Yes	Customer hard drive available for inspections and repair. Go to step 10.	
	No	Hard drive not present, troubleshoot hard drive and cable. Go to step 9.	
9. Troubleshoot hard drive and hard drive SATA cable with cable reseal and known-good part substitutions. If customer hard drive, is there a defective hard drive component to replace?	Yes	Reseat of SATA cable now has customer hard drive visible in Disk Utility, go to step 10	
		Defective hard drive SATA cable found and replaced, now has customer hard drive visible in Disk Utility, go to step 10	<b>X03</b>
		Suspect customer hard drive defective, attempt OS restore, go to step 10	
	No	Known-good hard drive and known-good hard drive SATA cable used, still no hard drive present. Replace logic board	<b>M19</b>
10. Boot system with Shift key down. Does it work?	Yes	Go to software troubleshooting article	
	No	Go to step 11	
11. Use Disk Utility to repair customer hard drive and repair permissions if system OS found on hard drive. Is hard drive bootable after software repairs?	Yes	OS on customer hard drive repaired, issue resolved.	
	No	Hard drive not bootable, perhaps missing OS, go to step 12	
12. Use Disk Utility to partition customer hard drive with one GUID partition then restore Mac OS from product OS install disc. Is hard drive bootable after OS install?	Yes	Customer hard drive now starts up from new OS image, issue resolved	
	No	Replace hard drive.	<b>H02</b>



## Intermittent Shutdown

Unlikely cause: hard drive, optical drive

### Troubleshooting Shutdown Issues

Before troubleshooting shutdown issues, always do the following:

- Run the available Apple diagnostics to check for cause of previous shutdown(s). Running ASD also helps isolate any abnormal value reading from a thermal, voltage, or current sensor or from a fan speed meter.
- Collect all available information from the user on shutdown details: periodicity, power state when issue happens, running applications, running time before shutdown.

#### User-related shutdowns

A computer shutdown may be caused by user operation. Shutting down the computer (by selecting the Shut Down menu, by pressing the power button for at least 4 seconds, or by programming a timed shutdown in the Energy Saver preferences) should not be considered as a failure unless the power button or the magnetic sleep sensors are found to be defective.

Suggested steps for troubleshooting:

- Reset SMC.
- Check Energy Saver preferences settings.
- Test top case button and magnetic sleep sensor operation and secure connection to logic board.

#### Activity-related system shutdowns

These shutdowns are linked to system settings, devices drivers, applications, or operating system freezes.

- System could not finish the standard shutdown process and had to force shutdown.
- An installed watchdog detected that an application did not respond within the specified time. (This watchdog can be enabled in Mac OS X Server Energy Saver preferences.)

Suggested steps for troubleshooting:

- Check the system logs and activity monitor utility for clues on the freezing process.
- Check for available software and firmware updates for installed device drivers, applications, or operating system.
- Start the system from a known-good and up-to-date bootable drive for issue reproduction.

#### Power-related system shutdowns

These shutdowns are due to power management, poor connections or defective power sources.

- External or battery power source was removed.
- Battery went empty while computer was on.
- Battery went empty while computer was asleep.



Suggested steps for troubleshooting:

- Reset SMC.
- Check that AC cable, AC adapter and battery connections are secure to logic board.
- Verify battery and power adapter sources using the Battery and Adapter test utility.

### Hardware-related system shutdown

These shutdowns are due to temperature, voltage, current, fan speed or other hardware-related sensor values going out of range.

- One of the temperature sensors reached a specified temperature limit.
- One of the voltage sensors reached a specified voltage limit.
- One of the current sensors reached a specified current limit.

Suggested steps for troubleshooting:

- Check all sensors connections and values using Apple Service Diagnostics and other available Apple Service utilities.
- Confirm correct Apple-branded battery and power adapter are installed.
- Check for abnormal battery temperature.
- Check fan(s) operation.
- Confirm cleanliness of heatsink fins and air flows.
- Confirm heatsink is correctly seated on logic board and thermal material is present.

### Quick Check

Symptom	Quick Check
<b>Intermittent shutdown</b> <ul style="list-style-type: none"><li>• Powers off during startup</li><li>• Powers off with desktop use</li></ul>	<ol style="list-style-type: none"><li>1. Collect details from customer on shutdown occurrence and system configuration when it happens (on battery, when running for a while, frequency of shutdowns, running applications, shutdown repeatability). If shutdown can be easily reproduced, check next steps:</li><li>2. Verify battery charge status</li><li>3. Check AC adapter MagSafe connector and connection with system</li><li>4. Reset SMC and PRAM</li><li>5. Start up with shift key down for safe mode</li><li>6. Startup from known-good bootable device</li><li>7. Run ASD for sensors + thermal tests</li></ol>



## Deep Dive

Check	Result	Action	Code
1. Activity related shutdowns: Reset SMC and PRAM and verify that shutdown issue still happens.	Yes	Check with known-good bootable drive: go to step 2	
	No	Shutdown cause was related to SMC or Pram programmed shutdown settings or corruption, and was resolved by reverting them to default settings.	
2. Booting from known-good bootable drive , verify that shutdown issue still happens.	Yes	Go to Power related shutdowns on step 3	
	No	Shutdown events do not happen on known-good OS. Reinstall Mac OS on customer hard drive, update OS with latest version and check if any firmware update is available.	
3. Power related shutdowns : verify that shutdown issue can ONLY be reproduced with user's battery and AC adapter.	Yes	Intermittent power issue means checking user's AC cable for intermittent connection, checking user's battery and AC adapter health,	
	No	Issue also happens with known-good battery and AC adapter. Go to step 4	
4. Reset SMC and PRAM, then verify if shutdown symptoms does not happen anymore.	Yes	Shutdown cause was related to SMC or Pram settings or corruption, and was resolved by reverting them to default settings.	
	No	Shutdown event still occurs. Go to step 5.	





<b>5.</b> Check system running on battery only. Use known-good charged battery. Verify if shutdown/reset/sleep issues disappear when known-good battery is used without AC adapter.	Yes	Recharge customer battery and retest. Check for customer battery health in Apple System Profiler or run Battery & Adapter Test utility, and replace battery if its health is reported bad or consumed.	<b>P09</b>
	No	Symptoms unchanged - Go to step 6	
<b>6.</b> Check with known-good AC adapter source only Remove battery and use known-good AC adapter. Verify if the shutdown/reset/sleep issues disappear with known-good adapter.	Yes	Faulty user's AC adapter. Replace user's AC adapter if AC cable and duckhead were confirmed good.	<b>P14</b>
	No	Symptoms unchanged - Go to Hardware-related shutdowns on step 7	
<b>7.</b> Hardware-related shutdowns: Run ASD or other latest available service utility and verify if a sensor failure is reported.	Yes	-If a temperature or a fan sensor failure is reported, go to step 8  -If a voltage or a current sensor failure is reported in ASD w/known good AC adapter and batteries, replace logic board.	<b>M23</b>
	No	Setup ASD to loop test suite for burn in tests and go to step 7. If no failure is found after burn in tests, return unit to customer for no failure found.	



8. Verify if a thermal sensor or fan failure is reported in ASD or other available service utility.	Yes	-If fan not running failure, check for fan cable seating and retest. If same failure after retest replace fan with known-good fan and retest. If issue does not happen with known-good fan, replace user's fan.  -If an over temp failure reported, check for cause of over temp, like obstructed vent, dust in heatsink fin, clogged fan and retest. If still failing replace part where sensor is located (logic board, battery, or trackpad) according to the sensor location table . Go to step 9	<b>X22</b>  <b>M23 P17 K99</b>
	No	Replace Thermal module Go to step 9	<b>X10</b>
9. Isolate if issue solved Verify if shutdown/issue does not happen anymore after part exchange.	Yes	Issue fixed	
	No	Replace logic board with corresponding symptom: -if for thermal error cause -if for other cause	<b>M18 M08</b>

## No Video/Bad Video

Unlikely cause: hard drive, optical drive, top case, battery, power adapter

### Quick Check

Symptom	Quick Check
<b>Power, but No Video</b> <ul style="list-style-type: none"><li>• Power</li><li>• No video</li><li>• fan, hard drive spin, or optical drive reset sound</li><li>• sleep LED is on or went on</li><li>• light if Caps Lock pressed</li></ul>	<ol style="list-style-type: none"><li>1. Reset SMC.</li><li>2. Reset PRAM.</li><li>3. If no startup chime, verify with known-good memory.</li><li>4. Verify with external monitor.</li><li>5. Press Alt key on startup..</li></ol>



## Deep Dive

Check	Result	Action	Code
1. Characterize video issue Define whether the issue is a bad image with backlight OR no video issue. Verify whether some image even distorted is visible.	Yes	Bad image quality, go to step 5	
	No	No image seen or image visible with no backlight, go to Step 2	
2. Isolate Peripherals as cause Disconnect all peripherals, external devices, and display adapters if present and verify that video is displayed.	Yes	Suspect peripherals as cause. Reconnect one at a time, verifying unit operation at each stage	
	No	Go to Step 3	
3. Adjust Brightness Power-on unit , attempt to adjust brightness to maximum using brightness (F1/F2) keys and verify that video is displayed.	Yes	Video displayed - Brightness set to minimum, panel backlight was inadvertently turned off. If backlight returns to low check for stuck F1 key on keyboard.	
	No	Go to Step 4	
4. Reset SMC Reset SMC and verify that system video is displayed.	Yes	Corrupt SMC State preventing video.	
	No	Go to Step 5	
5. Reset PRAM. If no action, use external keyboard with same sequence. Verify that system video is displayed.	Yes	Invalid or Corrupt PRAM contents affecting video output	
	No	Go to step 6	



<b>6.</b> Connect External video Connect known-good VGA/ DVI adapter to known-good display, press power button and close display to force main screen startup on external video. Verify that video is correct when displayed from external display.	Yes	Video correct on external display. Research available firmware and software updates, retest.  If returning with software already updated, go to Step 7	
	No	Replace logic board with according symptom code: -no video -bad/distorted video	<b>M03 M04</b>
<b>7.</b> Isolate LCD display detection Disconnect external monitor and reopen display and restart unit. Verify that sleep LED indicator goes off after internal LCD has been detected.	Yes	Sleep LED goes off when LCD detected. -If still no video then Go to step 8, -If video present, but with defect, go to step 9	
	No	Internal LCD not detected. Run Clamshell Service Diagnostic utility and check for LCD panel presence. If not found, reseal LVDS cable connection on logic board and retest. If sleep led does not go off after cable is reseated, go to step 10	
<b>8.</b> Check for sleep sensor condition If display assembly sleep sensor is stuck in a closed state, video will appear on internal display temporarily, until the OS sleeps the system. Disconnect IR/sleep cable and restart unit without external display. Verify that system starts up with video on internal display stays on and does not go into sleep mode.	Yes	Sleep sensor was stuck or had shorted cable. Replace IR/ sleep cable (or enclosing top case)	<b>X13</b>
	No	Symptoms unchanged - Go to Step 9	



<b>9.</b> Check for No Backlight Condition. Power on unit. Using a lamp or bright light source, inspect for faint image, and verify that any faint image appears.	Yes	Logo image visible - check LVDS cable on logic board. Inspect cable for damage near clutches: . if damaged, replace display assembly and go to step 11 . if cable is not damaged, run Clamshell Service Diagnostic utility and check for LCD panel presence. If not found, reseal it and retest, then go to step 11	<b>L09</b>
	No	If symptom continues, go to step 10.	
<b>10.</b> Verify with known-good display assembly Connect known-good display assembly to system.	Yes	System is functioning with known-good display assembly Replace display assembly if following symptom reporting: - had no power issue - had incorrect/missing colors - had blank video - had distorted / blurred video - had vertical/horizontal lines - had noise/unstable flickering - had dim backlight - had bad spot(s)/pixels - had no backlight - could not change resolution	<b>L01</b> <b>L02</b> <b>L03</b> <b>L04</b> <b>L05</b> <b>L06</b> <b>L07</b> <b>L08</b> <b>L09</b> <b>L10</b>
	No	Symptoms unchanged - replace logic board	<b>M03</b>
<b>11.</b> Verify with reseated LVDS cable or replaced display assembly Verify that unit now has video and backlight.	Yes	Issue was only due to damaged display assembly or unseated cable.	
	No	Display cable damaged the logic board. Replace logic board.	<b>M25</b>



## Battery Isn't Recognized or Won't Charge

Unlikely cause: display assembly, speakers, optical drive, hard drive, trackpad

### Quick Check

Symptom	Quick Check
<b>Battery isn't recognized or won't charge</b> <ul style="list-style-type: none"><li>• AC adapter</li><li>• No MagSafe LED indicator</li><li>• No orange charge indication</li><li>• Battery status LEDs:<ul style="list-style-type: none"><li>- single chase</li><li>- all flash</li><li>- no LED</li></ul></li></ul>	<ol style="list-style-type: none"><li>1. Check battery level and test AC power.</li><li>2. Test system with known-good battery.</li><li>3. Test customer's battery in known-good system.</li></ol>

### Deep Dive

Check	Result	Action	Code
1. Does the MagSafe LED go green to amber when connected to the system?	Yes	Battery is recognized and charging. Go to step 6	
	No	LED is green, Battery may be full or not recognized. Go to step 2	
		LED was on momentarily then went out. Go to No Power for system (M01)	
2. When the Battery status button is pressed, did any of the lights come on?	Yes	Go to step 3	
	No	Go to step 11	
3. Does battery status indicate a fully charge battery with all LEDs on?	Yes	Customer battery charged, check health. Go to step 13.	
	No	Go to step 4	
4. Does battery status indicate the battery is not recognized with a single LED on that chases back and forth 5 times?	Yes	Go to step 8 and tag battery as a possible P11 candidate.	(P11)
	No	Go to step 5	



5. Does battery status indicate the battery is recognized but not charging with all LEDs blinking?	Yes	Go to step 8 and tag battery as a possible P10 candidate	<b>(P10)</b>
	No	Go to step 6	
6. Does battery status indicate battery charge and flash the next level 5 times?	Yes	Customer battery charging, check battery condition. Go to step 13	
	No	Flashing first LED only, go to step 7	
		No battery status LEDs on, go to step 11	
7. Does battery status indicate a low battery with a LED flashing rapidly indicating initial charging of battery?	Yes	Allow customer battery to charge to 1 LED on before checking battery condition. Go to step 13.	
	No	Go to step 8	
8. Test with a known-good battery. Is battery recognized and charging?	Yes	Replace customer battery (P10 not charging or P11 not recognized)	<b>P10 or P11</b>
	No	Go to step 9	
9. Inspect customer battery contacts and battery cable connector for corrosion or obstructions.	Yes	Clear obstructions and replace the battery harness cable if corroded and recheck.	<b>X03</b>
	No	Go to step 10	
10. Reseat battery harness at logic board connector, and retest. Is battery recognized and charging?	Yes	Issue resolved by cable reseal. Check battery condition, go to step 13	
	No	Replace logic board	<b>M20</b>
11. Battery status LEDs not working - inspect button stuck or cable disconnect at logic board and reset SMC.	Yes	LED status now working. Go to step 3.	
	No	Go to step 12.	
12. Remove system battery and connect and test a known-good battery status indicator assembly. Do LEDs indicate a battery not recognized chase pattern?	Yes	Replace customer battery LED indicator assembly. Go to step 3	<b>X03</b>
	No	Replace customer logic board.	<b>M20</b>



13. Open Apple System Profiler and click on the Power Tab on the left. Is the battery over 300 cycle counts?	Yes	Battery has been consumed, and customer will need to purchase a replacement.	
	No	Go to step 14.	
14. Is battery less than a year old?	Yes	Go to step 16	
	No	Battery warranty expired, go to step 15	
15. Considering the age of the battery greater than one year old, is the health of the battery "Good" according to system profiler?	Yes	Battery is in good health and out of 1 year warranty coverage. Battery should continue to function until consumed.	
	No	Battery is consumed after warranty coverage. Customer to purchase a new battery.	
16. For batteries still covered by warranty, is the health of the battery "Good?"	Yes	Battery functioning normal. Go to step 17.	
	No	Battery has premature capacity loss. Replace customer battery.	<b>P08</b>
17. With battery charge greater than 20% does battery support system operation without AC connected?	Yes	Customer battery is good	
	No	Go to step 18	
18. Test with a known-good battery. Does known-good battery support battery only operation?	Yes	Replace customer battery for will not run system on battery alone	<b>P12</b>
	No	Replace logic board	<b>M20</b>





## Kernel Panic/System Crashes

Unlikely cause: Battery, Power Adapter

### Quick Check

Symptom	Quick Check
<b>Memory Issues/Kernel panic and freezes</b> <ul style="list-style-type: none"><li>• Display notice of system kernel panic during start up and desktop use.</li><li>• System freeze during use.</li><li>• System freeze upon wake from sleep.</li></ul>	<ol style="list-style-type: none"><li>1. Reset SMC and clear PRAM</li><li>2. Remove suspect external devices.</li><li>3. Verify user memory is Apple-approved memory, and memory configuration matches memory installed.</li><li>4. Start up with shift key down for safe mode.</li><li>5. Startup from known-good bootable device</li><li>6. Check panic.log info for crash cause</li><li>7. Run AHT for sensors test</li></ol>

### Deep Dive

Check	Result	Action	Code
1. Isolate Peripherals as cause. Disconnect all peripherals, external devices, and display adapters if present	Yes	Suspect peripherals as cause. Reconnect one at a time, verifying unit operation at each stage	
	No	Go to Step 2	
2. Reset SMC and clear PRAM then verify that unit starts without panic issues.	Yes	Issue resolved with default startup settings.	
	No	Go to step 3	



<b>3.</b> Boot in Safe Mode with Shift key down, and check for recent kernel panic data in panic log.  Open Panic.log file on hard drive and check for affected interface that crashed. If unit still crashes during startup, you will need to take out disk to a good system to access the file. Verify that kernel panic dependency is not with an I/O interface.	Yes	Kernel Panic is not a system I/O related device. Go to step 5	
	No	I/O device related crash, go to step 4	
<b>4.</b> Remove I/O device where possible to pinpoint faulty device:  - Disconnect camera cable from display assembly (for AirPort, Bluetooth, camera, and ambient light sensor). Camera cable can be disconnected without affecting startup and test.  - optical drive cable to isolate optical drive.  - hard drive cable to isolate hard drive.  Memory cards can be removed, relocated, or tested with known-good memory. Because system will run on one card, this is a useful test for finding bad memory or bad memory slot.  If issue remains after testing I/O device, replace with known-good part(s) to confirm issue resolved.	Yes	<p>System starts up when I/O device removed, replace affected I/O device or module containing it.</p> <p>If AirPort card presence is crashing system, replace AirPort card. If still issue, replace display assembly (for Bluetooth, camera, or cable damage).</p> <p>If optical drive presence is crashing system, replace optical drive cable and retest. If issue remains try with known-good optical drive. If still issue, replace optical drive.</p> <p>If hard drive presence is crashing system, replace hard drive cable and retest. If issue remains, try with known-good hard drive. If still issue, replace hard drive.</p> <p>Reseat memory or replace suspect memory with known-good memory.</p>	<p><b>N13</b> <b>L14</b></p> <p><b>X03</b> <b>J03</b></p> <p><b>X03</b> <b>H01</b></p> <p><b>X01</b></p>
	No	Symptoms unchanged, go to step 5	



5. Start up from optical drive or known-good OS. Attempt to start up with original or product install disc, or from an external hard drive with product OS installed, and verify that system starts without kernel panic.	Yes	Kernel panics cease running alternate OS. Run ASD/ DiskUtility to repair and test hard drive. If repair attempts fail, repartition hard drive and reinstall OS. Replace hard drive if restore fails.	<b>H03</b>
	No	Symptoms unchanged, go to Step 6	
6. Disconnect display assembly and test with known-good display assembly. Verify that system now starts up without kernel panic/freeze.	Yes	Replace display assembly.	<b>L14</b>
	No	Go to step 7	
7. Check for thermal values and fan running speed Run ASD to check for fan and sensors test, and verify that ASD does not report any overtemp, failing sensor, or fan.	Yes	No thermal fail detected - Replace logic board with matching symptom:  - If hang or freeze  - If Kernel Panic/system crashes	<b>M05</b>  <b>M06</b>
	No	If sensor test failed, reseal sensor connections on logic board and retest. If still failing, replace sensor or part where it is located (top case, display, other) : If top case sensor failed If display sensor failed If logic board sensor failed If fan test failed, replace fan. If overtemp , replace heatsink.	<b>X99</b> <b>L14</b> <b>M18</b> <b>X03</b> <b>X10</b>



## Battery Run Time Too Short

### Quick Check

Symptom	Quick Check
<b>Battery Run Time Too Short</b> Battery runs out of power very quickly (less than two hours)	<ol style="list-style-type: none"><li>1. Check if the battery is covered under a repair extension program. Use the “Portable Computer Battery Screening Process for Apple Service Providers” (<a href="#">Knowledge Base CP165</a>).</li><li>2. Verify no applications have runaway processes with the CPU. See “Runaway applications can shorten battery runtime” (<a href="#">Knowledge Base TS1473</a>).</li><li>3. Use “Apple Portables: Battery Life” (<a href="#">Knowledge Base HT1466</a>) to screen for short battery run time. If replaced for run time too short, regardless of warranty coverage, use symptom code <b>P09</b> if replaced.</li></ol>

## Won't Run on Power Adapter Alone

Unlikely cause: RAM, display assembly, hard drive, optical drive, top case, speakers, camera, microphone

### Quick Check

Symptom	Quick Check
<b>Won't Run on Power Adapter Alone</b> Runs on battery but not on power adapter only.	<ol style="list-style-type: none"><li>1. Verify proper wattage adapter is being used.</li><li>2. Check for dirty or stuck pins on the MagSafe connectors, both on the adapter and the computer.</li><li>3. Connect the AC adapter to known-good power source.</li><li>4. Verify power cord or plug is properly attached to AC adapter and MagSafe cable is not damaged.</li><li>5. With the battery removed, unplug AC adapter, reset SMC by holding the power button for 5 seconds</li></ol>



## Deep Dive

Check	Result	Action	Code
1. With battery removed, will a known-good AC adapter start up and run the system and show MagSafe LED status?	Yes	Confirm user's AC adapter as bad and replace.	<b>P14</b>
	No	Verify MagSafe board cable seating to logic board. Go to step 2	
2. Does a known-good power adapter's LED light up either green or amber?	Yes	SMC on logic board senses AC power adapter. Go to step 3	
	No	Replace the MagSafe board. Go to step 3.	
3. Does the unit run on known-good power adapter alone?	Yes	Issued resolved.	<b>X03</b>
	No	Replace logic board..	<b>M01</b>

## Power Adapter Issue

Unlikely cause: logic board, RAM, display assembly, hard drive, optical drive, top case, speakers, camera, microphone

## Quick Check

Symptom	Quick Check
<b>Power Adapter Issue</b> <ul style="list-style-type: none"><li>• No power</li><li>• No Power LED</li><li>• Non-operational</li><li>• Stuck /broken pin</li></ul>	<ol style="list-style-type: none"><li>1. Connect AC adapters MagSafe connector to the computer. The LED on the connector should be green or amber.</li><li>2. Verify power cord, or plug, is firmly attached to AC adapter.</li><li>3. Verify AC power source is supplying AC power.</li><li>4. Check for dirty or stuck pins on the MagSafe connectors, both on the adapter and the computer. Use and cleaning of power adapter with MagSafe</li><li>5. Remove battery, unplug AC adapter, and reset SMC by holding the power button for 5 seconds.</li></ol>



## Deep Dive

Check	Result	Action	Code
1. Verify that the MagSafe LED is green or amber while connecting a known-good AC adapter on customer system.	Yes	SMC on logic board senses AC power adapter and enabled power. Go to step 4.	
	No	Verify MagSafe interconnect board is connected to logic board. Go to step 2	
2. Does the unit run on known-good AC power adapter only?	Yes	Issued resolved.	<b>P99</b>
	No	Replace the MagSafe interconnect board. Go to step 3.	
3. Verify the MagSafe LED is green or amber while connecting known-good power adapter on customer system.	Yes	Bad MagSafe interconnect board. Issue resolved.	<b>X03</b>
	No	Go to step 4	
4. Does the customer's power adapter have stuck or bent pins on the MagSafe connector?	Yes	Replace power adapter.	<b>P15</b>
	No	Go to step 5	
5. Does the cable or duckhead have visible damage?	Yes	Replace cable or duckhead.	<b>P16</b>
	No	Go to step 6	
6. Check that LED on MagSafe connector is displaying both green (if battery charged) and orange (when charging).	Yes	Verify adapter with known-good unit and customer unit and troubleshoot source of error	
	No	Replace power adapter.	<b>P03</b>



## Noise / Hum / Vibration

Unlikely cause: RAM, display assembly, top case, camera, microphone, battery

### Quick Check

Symptom	Quick Check
<b>Noise / Hum / Vibration</b> Computer or AC adapter emits a noise or vibration.	<ol style="list-style-type: none"><li>1. Verify and reproduce the source of the noise from the computer / adapter with the customer.</li><li>2. If the AC adapter is the source of the noise disconnect and try a known-good adapter. ( a small amount of hum or vibration is normal with AC adapters ).</li></ol>

### Deep Dive

Check	Result	Action	Code
1. Use of a known-good AC adapter eliminates the noise/vibration.	Yes	Replace AC adapter.	<b>P04</b>
	No	Go to step 2	
2. Verify if the noise is heard through the speakers and / or headphones.	Yes	Go to step 3	
	No	Go to step 4	
3. Disconnect any peripheral devices, cards, or cables attached to the unit. Verify the noise is gone.	Yes	Check for possible ground loop.	
	No	Go to step 6	
4. Locate the source of the noise. Is the noise from an optical drive?	Yes	Check with a different media disc. Possible issue with disc label or out of balance media. If not related to media, and noise is above normal level, replace optical drive.	<b>J04</b>
	No	Go to step 5	
5. Is the noise from the hard drive?	Yes	Drives normally make noise when starting up or when the heads move. Replace drive if noise is above normal levels.	<b>H06</b>
	No	Go to step 6	



6. Is the noise coming from the fan?	Yes	The fan(s) are generally running in a slow mode, but may accelerated when intensive processing is required (calculation, 3D gaming, or screen saver animation). If still beyond expected sound level, check for interference of fan with other mechanical element of system (foam, bracket, shield) before replacing a noisy fan.	<b>X03</b>
	No	Go to step 7.	<b>P04</b>
7. Noise may be related to EMI foam gasket shorting some pads on logic board or some pins from LVDS connector. Follow Take Apart instructions to remove EMI foam gasket from LVDS cable and retest. Verify if noise is gone when operating without foam gasket.	Yes	Issue solved. Replace EMI foam gasket so that it covers connector frame and does not touch any part of logic board or connector pins.	
	No	Go to step 8	
8. Noise may be related to interference from electrical devices operating near the computer, or on the same AC power source. Verify if noise is gone when operating in a different location on a different AC circuit.	Yes	Perhaps operating the unit with a surge suppressor will eliminate or reduce the noise. Change location of use or limit use of other device that is inducing the noise.	
	No	Replace logic board.	<b>M99</b>





## Burnt Smell / Odor

Unlikely cause: Enclosure

### Quick Check

Symptom	Quick Check
<b>Burnt Smell / Odor</b> Computer or power adapter emits an odor or smell of smoke.	<ol style="list-style-type: none"><li>1. Disconnect the battery and AC adapter from the computer.</li><li>2. Attempt to identify the source of the odor. Visual clues are component damaged like capacitor chip popped or burn marks.</li><li>3. Check <a href="#">AirPort Card cable orientation</a>.</li></ol>

### Deep Dive

Check	Result	Action	Code
1. Has the source of the odor been identified.	Yes	Replace the affected part.	<b>P08</b>
	No	Go to step 2	
2. Are any burn marks visible on components?	Yes	Replace the affected part.	<b>P08</b>
	No	Go to step 3	
3. Refer to Liquid Submersion Indicators. Are any of the spill sensors red?	Yes	Refer to Knowledge Base article TS2274 "MacBook (Early 2008) and later: Liquid submersion indicators (LSI)."	
		Go to step 4	



4. Is the computer operating normally?	Yes	This could be related to normal operation. Refer to <a href="#">Knowledge Base: 24947</a> <a href="#">Odors may be present short-term.</a>	
	No	Please refer to best related troubleshooting section. If after inspecting the unit you feel there is a possible safety issue with the computer or AC adapter, please notify Apple.	

## Battery Leaking or Swollen

### Quick Check

Symptom	Quick Check
<b>Battery Leaking or Swollen</b> <ul style="list-style-type: none"><li>• Computer wobbles</li><li>• Trackpad button does not work</li><li>• Battery pack case has opened.</li><li>• Access door will not close</li></ul>	<ol style="list-style-type: none"><li>1. Check if the battery is covered under a repair extension program. Reference: MacBook, MacBook Pro (15-inch) or MacBook Pro (17-inch) with swollen battery article (<a href="#">Knowledge Base TS2358</a>).</li><li>2. Use the “Portable Computer Battery Screening Process for Apple Service Providers” (<a href="#">Knowledge Base CP165</a>) and use “Battery pack is visibly deformed” case under section 2E. Use symptom code <b>P13</b>.</li><li>3. Check locking lever mechanism.</li></ol>

## Uncategorized Symptom

### Quick Check

Symptom	Quick Check
<b>Uncategorized Symptom</b> Unable to locate appropriate symptom code	Verify whether existing symptom code applies to the issue reported by the customer. If not, document reported symptom and send feedback to <a href="mailto:smfeedback@apple.com">smfeedback@apple.com</a> stating that a suitable symptom code could not be found.



# Communications

## Ethernet Port/Device Issue

Unlikely cause: power adapter, battery, speakers, optical drive, hard drive, fan, camera, microphone, top case, display assembly, AirPort card

### Quick Check

Symptom	Quick Check
<b>Ethernet Port/Device Issue</b> <ul style="list-style-type: none"><li>• No Ethernet device present</li><li>• Unable to access network resources</li><li>• Ethernet device shows no connection</li><li>• Ethernet device unable to get an IP address</li><li>• Slow network performance</li></ul>	<ol style="list-style-type: none"><li>1. Check the network cable for damage, try a known good Ethernet cable – CAT5 or better recommended for 100Mbps+ connections.</li><li>2. Check Ethernet ports on Mac and wall/switch for dust, debris, damage or bent pins.</li><li>3. Ensure distance from networking infrastructure is less than 300 feet / 105 meters.</li><li>4. Verify port, cable and network hardware with a known good system. Isolate firewall, MAC address filtering or hardware access control devices.</li><li>5. Check system logs. Isolate OS by starting up from original install media (10.5.x) or compatible known good OS.</li></ol>

### Deep Dive

Check	Result	Action	Code
1. Visually inspect Ethernet connector to ensure all pins will make physical contact with CAT5 network cable.	Yes	Ethernet interface contacts are good. Go to step 2.	
	No	Pins are damaged or bent flat, replace logic board.	<b>M10</b>
2. Isolate OS by booting from original install media. Verify Network Link status active by using Network Utility on install DVD. If the Ethernet interface (en0) Link Status is inactive, recheck physical connect and link activity indicator on hub/switch.	Yes	Ethernet interface (en0) Link Status is active, go to step 3.	
	No	If connection is OK on known-good system, replace logic board.	<b>M10</b>



<b>3.</b> Verify if IP address is listed for the Ethernet interface in System Preferences: Network. Connect computer to network with known-good DHCP IP allocation, ensuring static DHCP maps or filtering is not preventing address allocation. Note: DHCP allocation may not be instantaneous depending on network. Retest.	Yes	Go to step 4.	
	No	If connection is OK on known-good system, replace logic board.	<b>M10</b>
<b>4.</b> Verify connection by using Network Utility to ping another connected computer on the same subnet. Ensure the target computer's IP address is valid, on the same subnet and powered on. Ensure no MAC address filtering or hardware access control devices are present. Use a simple hub/switch environment.	Yes	Go to step 5	
	No	If the symptoms do not change, replace the logic board.	<b>M10</b>
<b>5.</b> Verify Ethernet performance and reliability by starting up from a known-good OS install, and downloading a large file from a web site or file server.	Yes	If there is no performance or connectivity issue isolated solely to the system under test, the problem may be the network environment. No repair is necessary.	
	No	If there are connection dropouts or poor performance not seen on a known-good test system, replace the logic board.	<b>M10</b>



## AirPort/Bluetooth: Defective Wireless Devices

Unlikely cause: power adapter, battery, speakers, optical drive, hard drive, fan, camera, microphone, top case



**Caution:** When testing an AirPort card connection, wait at least 5 seconds after shutdown before touching the camera cable connection to the logic board. Waiting less than that could damage the AirPort card.

### Quick Check

Symptom	Quick Check
<b>AirPort or Bluetooth: Defective Wireless Devices</b> <ul style="list-style-type: none"><li>• Unable to join networks or pair devices</li><li>• Card not available or recognized</li><li>• Intermittent device or connection dropouts</li></ul>	<ol style="list-style-type: none"><li>1. Open System Preferences and make sure AirPort or Bluetooth is turned on and (for AirPort) that a network is selected.</li><li>2. Check that base station is not using unsupported connection and encryption protocols.</li><li>3. Check for nearby interference sources such as microwave ovens or cordless phones (<a href="#">Knowledge Base HT1365</a>)</li><li>4. Check the number of users trying to use AirPort in the area for possible network congestion.</li><li>5. Isolate OS by booting from original install media (10.5.x). Attempt to connect to base station (AirPort) or pair with wireless keyboard (Bluetooth).</li><li>6. Reset PRAM.</li></ol>

### Deep Dive

Check	Result	Action	Code
1. Open System Profiler, check to see if AirPort or Bluetooth is recognized. Ensure software and firmware updates for AirPort and Bluetooth have been applied.	Yes	(AirPort) Ensure MAC address filtering is not enabled on the base station.  (Bluetooth) Ensure target devices are set to discoverable.	
	No	If card is not detected or software updates do not resolve issue, go to step 2.	



2. Run Clamshell Service Diagnostic utility and check for all devices presence. If not found, reseal the camera cable connection to the logic board.	Yes	Loose logic board connection.	<b>N04</b>
	No	AirPort issue, go to step 3, Bluetooth issue go to step 7.	
3. (AirPort) Verify the antenna connections to the AirPort card are not reversed or loose. Reseat antenna and I/O cable connections.	Yes	Loose connections or crossed antenna.	<b>N04</b>
	No	If the connectors are secure, antenna connections not reversed and show no signs of damage or wear, go to step 4.	
4. (AirPort) Try a known-good AirPort antenna.	Yes	Replace AirPort antenna.	<b>N14</b>
	No	Continue to use known-good antenna, go to step 5.	
5. (AirPort) Try a known-good AirPort card.	Yes	Replace AirPort card.	<b>N12</b>
	No	Go to step 6.	
6. (AirPort) Try a known-good display assembly if available.	Yes	Replace display assembly.	<b>L16</b>
	No	Replace logic board.	<b>M11</b>
7. (Bluetooth) Enable Bluetooth and try a known good display assembly if available. Bluetooth circuitry in the clamshell is not accessible.	Yes	Replace display assembly.	<b>L16</b>
	No	Replace logic board.	<b>M11</b>



## No/Poor Wireless Signal

Unlikely cause: power adapter, battery, speakers, optical drive, hard drive, fan, camera, microphone, top case



**Caution:** When testing an AirPort card connection, wait at least 5 seconds after shutdown before touching the camera cable connection to the logic board. Waiting less than that could damage the AirPort card.

### Quick Check

Symptom	Quick Check
<b>No/Poor Wireless Signal</b> <ul style="list-style-type: none"><li>• Unable to find networks</li><li>• Intermittent connection dropouts</li><li>• Slow transfer speeds</li></ul>	<ol style="list-style-type: none"><li>1. Check for nearby interference sources in the 2.4/5GHz range such as microwave ovens and cordless phones (<a href="#">Knowledge Base HT1365</a>).</li><li>2. Check that computer is within base station range – move closer to base station.</li><li>3. Base station checks:<ol style="list-style-type: none"><li>a. Base station is not set to low-power transmission mode</li><li>b. Base station is not using unsupported connection and encryption protocols</li><li>c. Check for possible Wi-Fi channel overlap (nearby base stations using adjacent channel)</li></ol></li><li>4. Isolate OS by booting from original install media (10.5.x). Attempt to connect to base station.</li></ol>

### Deep Dive

Check	Result	Action	Code
1. Open System Profiler, check to see if AirPort card is recognized under Network: AirPort Card.	Yes	Use Software Update to make sure all AirPort software and firmware updates have been applied. Ensure base station is not using MAC address filtering or creating a hidden network.	
	No	If card is not detected, go to M11 - AirPort/Bluetooth - Defective wireless devices.	



2. Run Clamshell Service Diagnostic utility and check for all devices presence. If not found, reseal the camera cable connection to the logic board.	Yes	Loose logic board connection	<b>N04</b>
	No	Go to step 3.	
3. Verify the antenna connections to the AirPort card are not reversed or loose. Reseat antenna and I/O cable connections.	Yes	Loose connections or crossed antenna	<b>N04</b>
	No	If the connectors are secure, antenna connections not reversed and show no signs of damage or wear, go to step 4.	
4. Try a known-good AirPort antenna.	Yes	Replace AirPort antenna.	<b>N14</b>
	No	Continue to use known good antenna, go to step 5.	
5. Try a known-good AirPort card.	Yes	Replace AirPort card.	<b>N12</b>
	No	Continue to use known-good antenna & card; go to step 6.	
6. Try a known-good display assembly if available.	Yes	Replace display assembly.	<b>L16</b>
	No	Replace logic board.	<b>M11</b>

## Wireless Input Device Loses Connection

Unlikely cause: display assembly, speaker assembly, optical drive, hard drive



**Caution:** When testing an AirPort card connection, wait at least 5 seconds after shutdown before touching the camera cable connection to the logic board. Waiting less than that could damage the AirPort card.

### Quick Check

Symptom	Quick Check
<b>Wireless Input Device Loses Connection</b>	Check Bluetooth input device has fully charged batteries.





## Deep Dive

Check	Result	Action	Code
1. System Profiler should list Bluetooth radio device under system hardware. Is Bluetooth device available?	Yes	Bluetooth radio present, verify Bluetooth preference settings, go to step 2.	
	No	Attempt Bluetooth repair, go to step 5.	
2. System Preferences has a Bluetooth panel. Ensure Bluetooth is on and discoverable. Are there any devices listed in pairing window?	Yes	Choose known-good device and establish a connection. Go to step 3.	
	No	Attempt Bluetooth repair, go to step 5.	
3. Ensure a known-good Bluetooth device is on, in close range and in discoverable mode. Is computer pairing with known-good device?	Yes	Pairing verified, connect with user's device, go to step 4	
	No	Attempt Bluetooth repair, go to step 5.	
4. Is computer pairing with user's Bluetooth device?	Yes	Connection established, continue testing for connection loss, go to step 7.	
	No	Check for software updates for both computer & device.	<b>K07</b>
5. Run Clamshell Service Diagnostic utility and check for all devices presence. If not found, reseal camera cable on logic board. Is the Bluetooth radio present, on and pairing with a known-good device?	Yes	Loose cable connection.	<b>N04</b>
	No	Go to step 6.	
6. Install and test a known-good display assembly. Is the Bluetooth radio present, on and pairing with a known-good device?	Yes	Replace display assembly.	<b>L16</b>
	No	Replace logic board.	<b>M11</b>



7. Continue to actively test a known-good Bluetooth device to determine if there is a disconnect. Do not allow computer to sleep during this test. Is link lost during test?	Yes	Check for software update, 2.4 GHz radio interference or device low battery.	
	No	Known-good device passed, test with user's Bluetooth device.	
8. Continue to test user's Bluetooth device to determine if there is a disconnect. Do not allow computer to sleep during this test. Is link lost during test? If link is lost during start up, turn on System Preferences: Bluetooth: Advanced: "Open Bluetooth Setup Assistant at start up when no input device is present".	Yes	Check for software update, 2.4 GHz radio interference, device low battery or user's device features list for explanation.	
	No	User's device not losing connection. Issue not repeatable or resolved.	

## AirPort Card: Kernel Panic

Unlikely cause: power adapter, battery, speakers, optical drive, hard drive, fan, camera, microphone, top case



**Caution:** When testing an AirPort card connection, wait at least 5 seconds after shutdown before touching the camera cable connection to the logic board. Waiting less than that could damage the AirPort card.

## Quick Check

Symptom	Quick Check
<b>AirPort Card: Kernel Panic</b> <ul style="list-style-type: none"> <li>Kernel panic on boot</li> <li>Kernel panic or freezing while attempting to connect to Wi-Fi networks</li> <li>Kernel panic while transferring data on Wi-Fi networks.</li> </ul>	<ol style="list-style-type: none"> <li>Isolate OS by booting from original install media (10.5.x). Attempt to connect to Wi-Fi network.</li> <li>Use Software Update to make sure all AirPort software and firmware updates have been applied.</li> </ol>

## Deep Dive

Check	Result	Action	Code
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1. Use Software Update to make sure all AirPort/Bluetooth software and firmware updates have been applied. Ensure MAC address filtering is not enabled on the base station. Is kernel panic resolved?	Yes	Software issue.	
	No	Go to step 2.	
2. Reseat the camera cable connection to the logic board. Is kernel panic resolved?	Yes	Go to step 4.	
	No	Go to step 3.	
3. Isolate AirPort card by removing the I/O connection from the AirPort card. Reconnect camera cable connection to logic board. Is kernel panic resolved?	Yes	Go to step 4.	
	No	Go to M06 Kernel Panic / System Crashes.	
4. Connect and test with a known-good AirPort card. Is kernel panic resolved?	Yes	Replace AirPort card.	<b>N13</b>
	No	Replace display assembly.	<b>L16</b>

## Wireless Performance Issue / Slow Connection

Unlikely cause: power adapter, battery, speakers, optical drive, hard drive, fan, camera, microphone, top case



**Caution:** When testing an AirPort card connection, wait at least 5 seconds after shutdown before touching the camera cable connection to the logic board. Waiting less than that could damage the AirPort card.



## Quick Check

Symptom	Quick Check
<b>Wireless Performance Issue / Slow Connection</b> <ul style="list-style-type: none"><li>• Slow or stalled data transfers</li><li>• Intermittent connection dropouts</li></ul>	<ol style="list-style-type: none"><li>1. Check for nearby interference sources in the 2.4/5GHz range such as microwave ovens or cordless phones (<a href="#">Knowledge Base HT1365</a>)</li><li>2. (AirPort) Check the number of users trying to use AirPort in the area for possible network congestion. Move closer to base station to improve signal reception.</li><li>3. (Bluetooth) Move devices closer together.</li><li>4. Check performance with a known-good system</li><li>5. (AirPort) Wireless base station checks:<ol style="list-style-type: none"><li>a. Base station is not set to low-power transmission mode.</li><li>b. Base station is not set to a slower protocol mode (802.11b).</li><li>c. Check for possible Wi-Fi channel overlap (nearby base stations using adjacent channel).</li></ol></li><li>6. Isolate OS by booting from original install media (10.5.x). Attempt to connect to base station (AirPort) or pair with wireless keyboard (Bluetooth)</li><li>7. Use Software Update to make sure all AirPort and Bluetooth software and firmware updates have been applied.</li></ol>

## Deep Dive

Check	Result	Action	Code
1. Inspect the display clutch barrel for damage. AirPort radio is in display clutch barrel area.	Yes	Record damage: Proceed to possibly repair damaged parts, go to step 2	
	No	No visible damage, go to step 2	



2. Turn off Bluetooth. Retest AirPort performance. Bluetooth circuitry in the clamshell is not accessible. Refer to <a href="#">Knowledge Base TS1809</a> .	Yes	Possible AirPort interference from the Bluetooth card. Change AirPort base station channel. ( <a href="#">Knowledge Base TS1809</a> .)	<b>N06</b>
	No	Continue by checking connections, go to step 3	
3. Run Clamshell Service Diagnostic utility and check for all devices presence. If not found, reseal the camera cable connection to the logic board.	Yes	Loose logic board connection	<b>N04</b>
	No	AirPort issue, go to step 4, Bluetooth issue, go to step 8.	
4. (AirPort) Verify the antenna connections to the AirPort card are not reversed or loose. Reseat antenna and I/O cable connections.	Yes	Loose connection or crossed antenna	<b>N04</b>
	No	If the connectors are secure, antenna connections not reversed and show no signs of damage or wear, go to step 5	
5. (AirPort) Try a known-good AirPort antenna and verify that issue is fixed..	Yes	Replace AirPort antenna.	<b>N14</b>
	No	Continue to use known good antenna, go to step 6.	
6. (AirPort) Try a known-good AirPort card and verify that issue is fixed..	Yes	Replace AirPort card.	<b>N12</b>
	No	Continue to use known-good antenna & card, go to step 7.	
7. (AirPort) Try a known-good display assembly if available and verify that issue is fixed..	Yes	Replace display assembly.	<b>L16</b>
	No	Replace logic board.	<b>M11</b>
8. (Bluetooth) Enable Bluetooth and try a known-good display assembly if available and verify that issue is fixed..	Yes	Replace display assembly.	<b>L16</b>
	No	Replace logic board.	<b>M11</b>



## Wireless Input Device Doesn't Pair

Unlikely cause: display assembly, logic board, optical drive, hard drive

### Quick Check

Symptom	Quick Check
<b>Wireless Input Device Doesn't Pair</b> <ul style="list-style-type: none"><li>Can't get the system to recognize the Bluetooth keyboard or mouse</li></ul>	<ol style="list-style-type: none"><li>1. Check Bluetooth System Preference is set to Discoverable.</li><li>2. Check Bluetooth device has fully charged batteries.</li><li>3. Check for Bluetooth software updates for both the device and Mac OS X.</li><li>4. If the Bluetooth pairs with no problems, probe about potential interference issue at user's site.</li></ol>

### Deep Dive

Check	Result	Action	Code
1. System Profiler should list Bluetooth radio device under system hardware. Is Bluetooth device available?	Yes	Bluetooth radio present, verify Bluetooth preference settings, go to step 2.	
	No	Attempt Bluetooth repair, go to step 5.	
2. System Preferences has a Bluetooth panel. Ensure Bluetooth is on and discoverable. Are there any devices listed in pairing window?	Yes	Choose known-good device and establish a connection. Go to step 3.	
	No	Attempt Bluetooth repair, go to step 5.	
3. Ensure a known-good Bluetooth device is on, in close range and discoverable mode, Is system pairing with known-good device?	Yes	Pairing verified, connect with user's device, go to step 4.	
	No	Attempt Bluetooth repair, go to step 5.	
4. Is Bluetooth pairing with user's Bluetooth device?	Yes	Issue resolved.	
	No	Check for SW update for both System and user device.	



5. Run Clamshell Service Diagnostic utility and check for all devices presence. If not found, reseal camera cable with logic board. Is the Bluetooth radio present, on and pairing with a known-good device?	Yes	Bad logic board connection. Issue resolved.	
	No	Go to step 6.	
6. Install and test a known good clamshell. Is the Bluetooth radio present, on and pairing with a known-good device?	Yes	Replace display clamshell.	<b>L16</b>
	No	Replace logic board. Optional step 7.	<b>M11</b>
7. With the logic board replacement, is the Bluetooth now pairing?	Yes	Bad logic board. Issue resolved.	<b>M11</b>
	No	All parts replaced. Try minimum configuration troubleshooting.	

## Uncategorized Symptom

### Quick Check

Symptom	Quick Check
<b>Uncategorized Symptom</b> Unable to locate appropriate symptom code	Verify whether existing symptom code applies to the issue reported by the user. If not, document reported symptom and send feedback to <a href="mailto:smfeedback@apple.com">smfeedback@apple.com</a> stating that a suitable symptom code could not be found.



# Display

## Display Anomalies

### Quick Check

Symptom	Quick Check
<b>Display Anomalies</b> <ul style="list-style-type: none"><li>• Incorrect/missing colors</li><li>• Distorted/blurred image</li><li>• Pixel anomalies</li><li>• Vertical/horizontal lines</li><li>• Non-uniform brightness</li><li>• Image flicker</li><li>• Image persistence</li></ul>	<ol style="list-style-type: none"><li>1. Allow display to reach normal operating temperature for about 15 minutes before evaluating front-of-screen performance.</li><li>2. Check display preferences for use of custom display profile.</li><li>3. Check brightness setting.</li><li>4. Check for Software Updates.</li><li>5. Clean glass panel while checking for dust/debris.</li><li>6. Go to Deep Dive: General</li></ol>

### Deep Dive: General

Check	Result	Action	Code
1. Verify if user's issue is incorrect/missing colors.	Yes	Go to <a href="#">Incorrect/Missing Colors Deep Dive</a> .	
	No	Go to step 2.	
2. Verify if user's issue is distorted/blurred image.	Yes	Go to <a href="#">Distorted/Blurred Image Deep Dive</a> .	
	No	Go to step 3.	
3. Verify if user's issue is bright or dark pixel anomalies.	Yes	Go to <a href="#">Pixel Anomalies Deep Dive</a> .	
	No	Go to step 4.	
4. Verify if user's issue is vertical or horizontal lines.	Yes	Go to <a href="#">Vertical/Horizontal Lines Deep Dive</a> .	
	No	Go to step 5.	
5. Verify if user's issue is non-uniform brightness.	Yes	Go to <a href="#">Non-uniform Brightness Deep Dive</a> .	
	No	LCD functioning OK.	



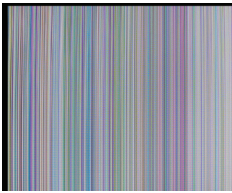


## Deep Dive: Incorrect/Missing Colors

Check	Result	Action	Code
1. Verify display is listed in the System Profiler's Graphics/Displays device tree.	Yes	This ensures color profile can be matched with LCD. Go to step 2.	
	No	Go to N09.	
2. Verify System Preferences Display Profile is valid for display being tested. Color profile should be set to Color LCD, user may have created an off-color calibration setting.	Yes	If display profile is valid and the colors are still incorrect or missing go to step 3.	
	No	Set System Preferences: Displays: Color to Color LCD and retest.	
3. Verify that the glass panel is free of contaminants.	Yes	Go to step 4.	
	No	Clean glass panel using approved method. Retest.	
4. Run Clamshell Service Diagnostic utility and check for LCD panel presence. If not found, reseal and verify LVDS cable is secure to the logic board. Are colors restored?	Yes	Loose cable connection. Issue resolved.	
	No	Go to step 5.	
5. Set desktop pattern in System Preferences to 'Solid Gray Light'. Verify if incorrect/missing color issue affects entire display.	Yes	Test a known-good display, go to step 7.	
	No	Go to step 6.	
6. Set up display under test side by side with another known good display showing the same image. Verify if issue is noticeably worse on the display being tested.	Yes	Test a known-good display, go to step 7	L02
	No	Small variations in color uniformity are normal and do not warrant replacement or repair of the display.	
7. Substitute a known-good display assembly to test logic board video output. Is normal video restored?	Yes	Replace display assembly.	L02
	No	Replace logic board.	M04

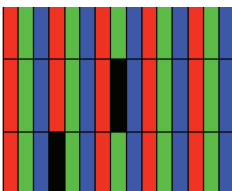
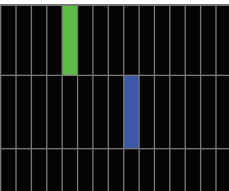


## Deep Dive: Distorted/Blurred Image



Check	Result	Action	Code
1. Sample image illustrates loss of LVDS data signals to LCD or a defective LCD panel. Inspect & reseal LVDS cable connection looking for damaged or bent pins. Is image restored with reseated cable connection?	Yes	Issue due to loose connection. Display issue resolved.	
	No	Go to step 2.	
		If logic board connector damage, replace logic board.	<b>M24</b>
2. Substitute a known good display clamshell to test logic board video output. Is normal video restored?	Yes	Replace display assembly.	<b>L04</b>
	No	Replace logic board.	<b>M04</b>

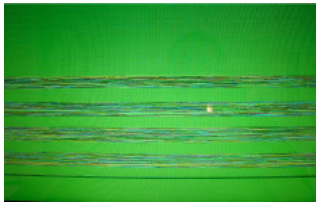
## Deep Dive: Pixel Anomalies



Check	Result	Action	Code
1. Determine if “defects” are dust/debris on surface of glass panel.	Yes	Clean glass panel.	
	No	Go to step 2.	
2. Determine if bright pixel defects exceed the acceptable number. See <a href="#">Display Issue: Pixel Anomalies</a> .	Yes	Replace display assembly.	<b>L08</b>
	No	LCD meets bright pixel defect specifications. Go to step 3.	
3. Determine if dark pixel defects exceed the acceptable number. See <a href="#">Display Issue: Pixel Anomalies</a> .	Yes	Replace display assembly.	<b>L08</b>
	No	LCD meets dark pixel defect specifications. Go to step 4.	
4. Determine if the combination of bright/dark pixel defects exceed the acceptable number. See <a href="#">Display Issue: Pixel Anomalies</a> .	Yes	Replace display assembly.	<b>L08</b>
	No	Explain to user that LCD is within specifications. Do not replace display assembly.	



## Deep Dive: Vertical/Horizontal Lines



Check	Result	Action	Code
1. Horizontal lines may be related to a failing RAM module. Verify if video issue only happens AFTER the Apple logo and the spinning wheel has appeared.	Yes	Issue only happens AFTER Apple logo and spinning wheel appears. Go to step 2.	
	No	Issues happens since startup. Go to step 5.	
2. Start with shift key down (safe mode) to disable system extensions. Verify if issue still happens when booting in safe mode.	Yes	Go to step 5.	
	No	No video issue when booting in safe mode. Go to step 3.	
3. Isolate with only one memory module installed , then with the other one. Test with known-good memory. Verify that issue only happens with specific RAM module(s).	Yes	Replace affected RAM module.	<b>X02</b>
	No	Go to step 4	
4. Isolate with one known-good memory module installed in one of the memory slots. Repeat by testing in the other memory slot with known-good memory module. Verify that issue only happens with specific memory slot on logic board.	Yes	Replace logic board.	<b>M07</b>
	No	Go to step 5	
5. Run Clamshell Service Diagnostic utility and check for LCD panel presence. If not found, reseal the LVDS cable to the logic board internal video output. Is normal video restored?	Yes	Issue resolved by reseating loose LVDS cable..	
	No	Go to step 6	
6. Connect external compatible DisplayPort display (or DisplayPort adapter and display). Verify if correct video appears on external display.	Yes	Go to step 7.	
	No	Replace logic board	<b>M04</b>



7. Substitute a known-good display assembly module to test logic board LVDS video output. Is normal video restored?	Yes	Replace display assembly module.	<b>L05</b>
	No	Replace logic board.	<b>M04</b>

### Deep Dive: Non-uniform Brightness

Check	Result	Action	Code
1. Determine if brightness uniformity issue is visible after display has warmed up for 15 minutes.	Yes	Go to step 2.	
	No	Display backlight can take several minutes to stabilize.	
2. Check LVDS cable connection to logic board.	Yes	Reseat LVDS cable	
	No	Got to step 3	
3. Determine if variation in uniformity appears excessive when compared to another similar unit.	Yes	Replace display assembly.	<b>L07</b>
	No	Explain to user that LCD appears to meet specifications.	





## Defective Camera / Built-in iSight Not Operating Correctly

### Quick Check

Symptom	Quick Check
<b>Defective Camera</b> <ul style="list-style-type: none"><li>• Camera not detected</li><li>• No green LED for camera</li><li>• Excessive blooming</li><li>• Poor white balance</li><li>• Poor focus</li><li>• Green image</li><li>• Image distortion</li></ul>	<ol style="list-style-type: none"><li>1. Check for Software Updates.</li><li>2. Verify camera lens and glass panel are clear of contaminants.</li><li>3. Ask customer about their lighting. Foggy image can be due to off-axis lighting. Low lighting results in poor image quality.</li><li>4. Moire patterns in image can be caused by stripes or mesh texture in subject.</li></ol>

### Deep Dive

Check	Result	Action	Code
1. Launch System Profiler and confirm that "Built-in iSight" is listed under USB High-Speed Bus.	Yes	Camera recognized. Go to step 3	
	No	Go to step 2.	
2. Run Clamshell Service Diagnostic utility and check for all devices presence. If not found, inspect and reseal camera cable on logic board. Is iSight listed in System Profiler?	Yes	Camera recognized. Go to step 3.	
	No	Go to step 4.	
3. Launch PhotoBooth. Verify that camera's green LED is on and image appears normal.	Yes	Issue resolved..	
	No	Go to step 4.	
4. Substitute a known-good display assembly to test logic board camera connection. Is iSight camera operating properly?	Yes	Replace display assembly.	<b>X11</b>
	No	Replace logic board.	<b>M13</b>



## Blank / No Video

Unlikely cause: power adapter, speakers, optical drive, hard drive, fan, microphone, top case,

### Quick Check

Symptom	Quick Check
<b>Blank / No Video</b> <ul style="list-style-type: none"><li>No video</li><li>No backlight</li></ul>	<ol style="list-style-type: none"><li>Check brightness setting</li><li>Attach known-good supported external display.</li><li>Boot from Mac OS X install DVD that came with computer.</li></ol>

### Deep Dive

Check	Result	Action	Code
1. Verify boot chime present when system restarted. Reset SMC and clear PRAM if necessary for proper start up. Is LCD video present?	Yes	Go to step 3.	
	No	Go to step 2.	
2. Connect known-good supported external display. Verify whether image appears on external display when system is booted.	Yes	External display detected by system. Go to step 3.	
	No	Go to No Video symptom code flow.	
3. Verify if LCD backlight is on by looking for faint glow from display when viewed in darkened room with brightness adjusted to full.	Yes	Video signal from system to external video is OK, LCD backlight is on. Go to step 5.	
	No	Go to step 4.	
4. Shine bright (low heat) flashlight into the front of LCD. Verify if Apple logo on the back of display glows.	Yes	Image present but backlight is not on. Check logic board connections. Go to step 5.	
	No	Go to No Video symptom code flow.	
5. Run Clamshell Service Diagnostic utility and check for LCD panel presence. If not found, reseal and verify that the display connection to the logic board is secure. Verify if image is restored after reseating loose connector.	Yes	Issue resolved.	
	No	Continue to test with known-good display assembly. Go to step 6.	



6. Verify LCD video works with a known-good display assembly.	Yes	Replace display assembly.	L03
	No	Go to No Video symptom code flow.	

## Backlight Issue / No Backlight

Unlikely cause: power adapter, battery, speakers, optical drive, hard drive, fan, microphone, top case,

### Quick Check

Symptom	Quick Check
<b>Backlight Issue / No Backlight</b> <ul style="list-style-type: none"><li>• Display not illuminated</li><li>• Flashing, unstable, or non-uniform backlight</li><li>• Poor backlight at some or all settings</li></ul>	Check that brightness setting is above minimum.

### Deep Dive

Check	Result	Action	Code
1. Connect external display, clear PRAM to set brightness to default level and verify if Color LCD is listed in the System Profiler's Graphics/Displays device tree.	Yes	Display panel detected by system. Go to step 3.	
	No	Go to step 2.	
2. Unplug and reseal the LVDS cable at the logic board. Repeat verification in System Profiler.	Yes	Display panel detected by system. Go to step 3.	
	No	Go to step 4.	
3. Darken room and verify backlight by detecting if any glow is emitted from the Apple logo on the back of display	Yes	Backlight operating. Go to step 5.	
	No	Go to step 4.	



4. Swap memory with known-good memory to determine if video issue is ram related..	Yes	Reseat or replace defective memory	X01
	No	Go to step 5	
5. Inspect LVDS connectors and cable under magnification for pinched cables and damaged or bent pins. Do any of the connections appear to be defective?	Yes	Defective LVDS cable. Replace display assembly.  Defective LVDS connector on logic board. Replace logic board.	M25
	No	If connections are OK and secure and the display is still blank, go to step 6.	
6. Substitute a known-good display clamshell to test logic board video output. Is backlight and display text back to normal?	Yes	Replace display assembly.	L09
	No	Poor or no backlight LED Driver power at logic board. Replace logic board.	M25

## Noise / Unstable Flickering

Unlikely cause: power adapter, battery, speakers, optical drive, hard drive, fan, microphone, top case,

### Quick Check

Symptom	Quick Check
<b>Noise / Unstable Flickering</b> <ul style="list-style-type: none"><li>Image flicker</li><li>Audible noise</li></ul>	1. Verify known-good source sound file not causing speaker distortion.

### Deep Dive

Check	Result	Action	Code
1. Verify if user's issue is due to video flickering coming from display.	Yes	Suspected flickering issue, go to step 2.	
	No	Audible noise issue, go to step 5.	





2. Verify display listed in the System Profiler's Graphics/Displays device tree is not disappearing intermittently (refresh System Profiler to observe).	Yes	Power and LCD panel ID are OK. Go to step 3.	
	No	Go to No Video symptom code flow.	
3. Backlight flickering may be related to EMI foam gasket shorting some pads on logic board or some pins from LVDS connector. Follow Take Apart instructions to remove the EMI foam gasket from LVDS cable and retest. Verify if flickering is gone when operating without foam gasket.	Yes	Issue solved. Replace EMI foam so that it covers the connector frame, and does not touch any part of logic board or connector pins.	
	No	Go to step 4.	
4. Inspect and reseal the LVDS cable and camera cable connection between display and logic board. Also test if brightness setting is a contributing factor. Has flickering stopped?	Yes	Loose cable connection. Issue resolved.	
	No	Go to step 5.	
5. Substitute a known good display assembly to test logic board video output. Has flickering stopped?	Yes	Replace display assembly.	<b>L06</b>
	No	Replace logic board.	<b>M04</b>
6. Verify the source of the noise is the electrical as opposed to mechanical. Audio noise should not be a concern now that LCD components are all solid state devices including LED backlights.	Yes	Noises that are not audible from the normal user position are considered acceptable. Return unit to the user.	
	No	Noise from another source. Go to Noise/Hum/Vibration symptom table..	



## Mechanical/Physical Damage

### Quick Check

Symptom	Quick Check
<b>Mechanical/Physical Damage</b> <ul style="list-style-type: none"><li>• Broken glass</li><li>• Broken hinge</li><li>• Stripped screw/head</li><li>• Stripped screw boss</li><li>• Dent or scratch to chassis</li></ul>	<ol style="list-style-type: none"><li>1. Determine damage caused by user/technician environment, accidental damage, or abuse.</li><li>2. Inform user/technician the failures are not covered by Apple warranties. Refer to <a href="http://www.apple.com/legal/warranty">http://www.apple.com/legal/warranty</a></li></ol>

## Cosmetic Defects

### Quick Check

Symptom	Quick Check
<b>Cosmetic Defects</b> <ul style="list-style-type: none"><li>• Cracked LCD</li><li>• Scorched or melted LCD</li><li>• LCD impact damage</li></ul>	<ol style="list-style-type: none"><li>1. Determine damage caused by user/technician environment, accidental damage, or abuse.</li><li>2. Inform user/technician the failures are not covered by Apple warranties. Refer to <a href="http://www.apple.com/legal/warranty">http://www.apple.com/legal/warranty</a></li></ol>

## Uncategorized Symptom

### Quick Check

Symptom	Quick Check
<b>Uncategorized Symptom</b> Unable to locate appropriate symptom code	Verify whether existing symptom code applies to the issue reported by the user. If not, document reported symptom and send feedback to <a href="mailto:smfeedback@apple.com">smfeedback@apple.com</a> stating that a suitable symptom code could not be found.



# Mass Storage

## Hard Drive Read/Write Issue

Unlikely cause: LCD, speakers, fan, camera, microphone

### Quick Check

Symptom	Quick Check
<b>Hard Drive Read/Write Issue</b> <b>Bad Sector/Defective</b> <b>Drive Formatting Issue</b> <ul style="list-style-type: none"><li>• Cannot save documents</li><li>• Read/Write error message</li><li>• Hang when accessing or saving data</li></ul>	<ol style="list-style-type: none"><li>1. Boot from Install DVD. Verify S.M.A.R.T. status of drive using Disk Utility.</li><li>2. Repair disk using Disk Utility.</li><li>3. Erase disk and reinstall Mac OS using Installer.</li></ol>

### Deep Dive

Check	Result	Action	Code
1. Start up from Restore DVD and launch Disk Utility. Is hard drive available for Disk Utility to repair?	Yes	Go to step 2.	
	No	Go to step 3.	
2. Did Disk Utility mount and repair hard drive successfully? Reseat hard drive if necessary.	Yes	Restart computer. Go to step 6.	
	No	If computer has not been verified with a known-good hard drive, go to step 3; otherwise, go to step 7.	
3. Substitute a known-good bootable hard drive, does system start up to desktop?	Yes	Reinstall user's drive, go to step 2.	
	No	Continue to use known-good bootable hard drive to determine root cause. Go to step 4.	



4. After reseating hard drive SATA and logic board connections, does known-good hard drive boot to desktop?	Yes	Reinstall user's drive, go to step 2	
	No	Suspect hard drive SATA cable, go to step 5.	
5. Replace hard drive SATA cable and retest with known-good hard drive.	Yes	Reinstall user's drive, go to step 2.	<b>X03</b>
	No	Replace logic board.	<b>M19</b>
6. Did user's hard drive start up successfully?	Yes	Issue resolved.	
	No	Repair or replace hard drive, go to step 7.	
7. Partition, erase & install Mac OS on user's hard drive. Did install complete without error and start up successfully?	Yes	Issue resolved	
	No	Hard drive appears to be defective, go to step 8.	
8. Replace user's hard drive. Does drive format correctly with a GUID partition map and install Mac OS without errors?	Yes	Issue resolved.	<b>H01</b>
	No	SATA cable verified or replaced and new hard drive installed, replace logic board.	<b>M19</b>

## Hard Drive Not Recognized/Not Mounting

Unlikely cause: LCD, speakers, fan, camera, microphone, AirPort

### Quick Check

Symptom	Quick Check
<b>Hard Drive Not Recognized/ Mount Drive No Boot</b> <ul style="list-style-type: none"> <li>Flashing question mark</li> <li>Boots to grey screen</li> <li>Boots to blue screen</li> </ul>	<ol style="list-style-type: none"> <li>Use a known-good mouse. Stuck mouse button will not allow boot.</li> <li>Boot from Install DVD. Verify S.M.A.R.T. status of drive using Disk Utility.</li> <li>Repair disk using Disk Utility.</li> <li>Erase disk and reinstall Mac OS using Installer.</li> </ol>



## Deep Dive

Check	Result	Action	Code
1. Boot from Restore DVD and launch Disk Utility. Is hard drive available for Disk Utility to repair?	Yes	Go to step 2.	
	No	Go to step 3.	
2. Did Disk Utility mount and repair hard drive successfully? Reseat hard drive if necessary.	Yes	Restart computer, go to step 6.	
	No	If computer has not been verified with a known-good hard drive, go to step 3; otherwise, go to step 7.	
3. Substitute a known-good bootable hard drive, does computer start up to desktop?	Yes	Install user drive, go to step 2.	
	No	Continue to use known-good bootable hard drive to determine root cause. Go to step 4.	
4. After reseating SATA and logic board connections, does known-good hard drive start up to desktop?	Yes	Install user drive, go to step 2.	
	No	Suspect hard drive SATA cable, go to step 5.	
5. Replace hard drive SATA cable and retest with known-good hard drive.	Yes	Install user drive, go to step 2.	<b>X03</b>
	No	Replace logic board.	<b>M19</b>
6. Did user's hard drive start up successfully?	Yes	Issue resolved.	
	No	Restore or replace user's hard drive, go to step 7.	
7. Partition, erase & install Mac OS on user's hard drive. Did install complete without error and start up successfully?	Yes	Issue resolved.	
	No	Hard drive appears to be defective. Go to step 8.	
8. Replace user's hard drive. Does drive format correctly with a GUID partition map and install Mac OS without errors?	Yes	Issue resolved.	<b>H01</b>
	No	SATA cable verified or replaced and new hard drive installed, replace logic board.	<b>M19</b>



## Hard Drive Noisy

Unlikely cause: LCD, speakers, fan, camera, microphone

### Quick Check

Symptom	Quick Check
<b>Hard Drive Noisy</b> <ul style="list-style-type: none"><li>Noise during start up</li><li>Noise during operation</li><li>Noise when drive is copying or saving data</li></ul>	<ol style="list-style-type: none"><li>Start up from Install DVD. Verify S.M.A.R.T. status of hard drive using Disk Utility.</li><li>Repair disk using Disk Utility.</li><li>Check for reported noise and compare with Knowledge Base article "Apple Portables: Hard Drives and Noise" <a href="http://support.apple.com/kb/TS2354">http://support.apple.com/kb/TS2354</a></li></ol>

### Deep Dive

Check	Result	Action	Code
1. Boot from Restore DVD and launch Disk Utility. Is hard drive available for Disk Utility to repair?	Yes	Go to step 2.	
	No	Replace hard drive or go to H01 Drive not recognized/ mount.	
2. Repair disk using Disk Utility and verify it completed successfully	Yes	Restart computer. Go to step 3.	
	No	Go to step 4.	
3. Is hard drive still noisy?	Yes	Remove hard drive and start up from external drive to test fan noise. Go to step 6.	
	No	Issue resolved.	
4. Erase disk and reinstall Mac OS using Installer. Did process complete?	Yes	Restart computer. Go to step 3.	
	No	Replace hard drive. Go to step 5.	<b>H06</b>



5. After installing new hard drive, do you still have drive noise?	Yes	Remove hard drive and start up from external drive to test fan noise. Go to step 6.	
	No	Issue resolved.	
6. After removing hard drive, verify if the system is still noisy.	Yes	Fan noise or optical drive noise likely to be the cause. See ODD Noisy table and Fan failures/Thermal issues table.	
	No	Go to step 7.	
7. Install a known-good hard drive and verify if the noise level is similar to user's hard drive.	Yes	Hard drive noise level is similar to a known-good drive and does not require replacement.	
	No	Replace hard drive. Go to step 5.	<b>H06</b>

## Optical Drive Won't Accept/Reject Media

Unlikely cause: LCD, speakers, fan, camera, microphone

### Quick Check

Symptom	Quick Check
<b>Optical Drive Won't Accept/Reject Media</b> <ul style="list-style-type: none"><li>• Cannot insert a disc into the drive</li><li>• Cannot eject a disc placed into the drive</li></ul>	<ol style="list-style-type: none"><li>1. Use Apple System Profiler ATA section to see if the optical drive appears. If not, see Optical Drive Not Recognized.,</li><li>2. Restart computer and hold down mouse button or keyboard eject key to cycle optical drive.</li><li>3. Inspect optical drive slot for obstructions</li></ol>



## Deep Dive

Check	Result	Action	Code
1. Is optical drive listed in the device tree for serial-ATA devices in System Profiler?	Yes	Optical drive has power, inspect disc acceptance. Go to step 5.	
	No	Inspect hardware. Go to step 2	
2. Verify all connections between logic board, flex cable, and optical drive are secure. Visually inspect cables and connectors for any debris, damage, or bent pins. Is optical drive now listed in System Profiler?	Yes	Optical drive has power, inspect disc acceptance. Go to step 5.	
	No	Replace any damaged cables and retest. If connections are good and with no visible cable damage, go to step 3.	<b>X03</b>
3. Disconnect user's optical drive by lifting SATA cable at logic board and connecting a known good optical drive assembly. Is optical drive now listed in System Profiler?	Yes	SATA port functional, reconnect user's optical drive & SATA cable. Go to step 4.	
	No	Replace logic board.	<b>M19</b>
4. Install and test user's optical drive with replacement SATA flex cable. Is optical drive now listed in System Profiler?	Yes	Cable change resolved issue.	<b>X03</b>
	No	Replace the optical drive. (Mechanical damage to optical drive, if found)	<b>J03</b> <b>(J06)</b>
5. Inspect optical drive slot for disc insert/eject. Is there clearance for disc use?	Yes	Go to step 6.	
	No	Replace damaged optical drive or system top case that interferes with disc use.	<b>J01</b> <b>(J05)</b> <b>X13</b>
6. Insert known-good disc and test user's optical drive for acceptance of disc. Does disc auto eject?	Yes	Replace the optical drive. (Mechanical damage to optical drive, if found)	<b>J03</b> <b>(J06)</b>
	No	Go to step 7.	
7. Does disc mount to desktop?	Yes	Go to Eject Test step 8.	
	No	Go to Optical Drive Read/Write Data Error troubleshooting page.	





8. Does disc eject properly from optical drive?	Yes	Issue resolved.	
	No	Replace optical drive or top case that interferes with disc ejection.	<b>J02 X13</b>
9. With replacement flex cable and interconnect board, is disc now recognized?	Yes	Issue resolved.	
	No	Replace optical drive. If drive has already been replaced, then replace logic board.	<b>J03</b>

## Optical Drive Read/Write Data Error

Unlikely cause: LCD, speakers, fan, camera, microphone

### Quick Check

Symptom	Quick Check
<b>Optical Drive Read/Write Data Error</b> <ul style="list-style-type: none"><li>Errors when writing optical media.</li><li>Errors when reading optical media.</li><li>Hang when accessing or preparing to write data.</li></ul>	<ol style="list-style-type: none"><li>Test optical media in another drive of the same type in same type of machine to rule out media issue.</li><li>Check with known-good discs like the Install discs that came with the computer.</li><li>For write issues, check with known-good media that performs well in another computer and optical drive of the same type.</li><li>Check both CD and DVD media. If only one type of media is producing errors, there is a laser issue. (J99)</li></ol>

### Deep Dive

Check	Result	Action	Code
1. Is media free to spin without optical drive scraping edge or surface of media?	Yes	Go to step 2.	
	No	Replace optical drive.	<b>J03</b>



2. Can optical drive read both CD and DVD known-good media?	Yes	Go to step 6	
	No	Reading CD only or DVD only indicates laser issue, replace optical drive.	<b>J03</b>
		Optical drive cannot read any media reliably, go to step 3.	
3. Reseat cable connections at logic board and optical drive. Verify that media is now recognized and reads reliably.	Yes	Reseat resolved issue.	<b>X03</b>
	No	Go to step 4.	
4. Disconnect optical drive by lifting SATA cable at logic board and connecting a known-good optical drive. Verify that media is now recognized and reads reliably.	Yes	SATA port functional, reconnect user's optical drive & SATA cable. Go to step 5.	
	No	Replace logic board.	<b>M19</b>
5. Install and test with replacement optical drive SATA flex cable. Verify that media is now recognized and reads reliably.	Yes	Cable change resolved issue.	<b>X03</b>
	No	Replace the optical drive. (Mechanical damage to optical drive, if found)	<b>J03 (J05)</b>
6. Test write data to compatible CD and DVD media. Verify burned media is recognized and reads reliably.	Yes	Issue resolved.	
	No	Replace the optical drive. (Mechanical damage to optical drive, if found)	<b>J03 (J06)</b>



## Optical Drive Not Recognized/Mount

Unlikely cause: LCD, speakers, fan, camera, microphone

### Quick Check

Symptom	Quick Check
<b>Optical Drive Not Recognized/Mount</b> <ul style="list-style-type: none"><li>Discs inject and eject, but do not appear in Finder</li></ul>	<ol style="list-style-type: none"><li>Use Apple System Profiler ATA section to see if the optical drive appears.</li><li>Serial-ATA section of Apple System Profiler will show any media inserted.</li><li>Check Finder Preferences: General and make sure "CD's, DVD's and iPods" is checked under "Show these items on the Desktop."</li><li>Check both CD and DVD media. If only one type of media is recognized, there might be a laser related issue. (J99)</li></ol>

### Deep Dive

Check	Result	Action	Code
1. Is optical drive listed in the device tree for SATA devices in System Profiler?	Yes	Issue resolved.	
	No	Go to step 2.	
2. Verify all connections between logic board, flex cable, optical drive are secure. Visually inspect cables and connectors for any debris, damage, or bent pins. Is optical drive now listed in System Profiler?	Yes	Issue resolved.	
	No	Replace any damaged cables and retest. If connections are good and with no visible cable damage, go to step 3.	<b>X03</b>
3. Disconnect optical drive by lifting SATA cable at logic board and connecting a known-good drive. Is optical drive now listed in System Profiler?	Yes	SATA port functional, reconnect user's optical drive & SATA cable. Go to step 4.	
	No	Replace logic board.	<b>M19</b>
4. Install and test with replacement optical drive SATA flex cable. Is optical drive now listed in System Profiler?	Yes	Cable change resolved issue	<b>X03</b>
	No	Replace the optical drive. (Mechanical damage to optical drive, if found)	<b>J03 (J05)</b>



## Optical Drive Noisy

Unlikely cause: LCD, speakers, fan, camera, microphone

### Quick Check

Symptom	Quick Check
<b>Optical Drive Noisy</b> <ul style="list-style-type: none"><li>Noise during boot</li><li>Noise during operation</li><li>Noise when drive is copying or writing data</li></ul>	<ol style="list-style-type: none"><li>Test optical media in another drive of the same type in same type of computer to rule out media issue.</li><li>Check with known-good discs. Install discs that came with the computer.</li><li>Check to see if noise occurs without media in the drive. If so, check for hard drive (H06) and fan (M18) caused noise.</li></ol>

### Deep Dive

Check	Result	Action	Code
1. Is optical drive constantly seeking or cycling eject mechanism without an optical disc installed? Optical drive should perform only one reset sequence and rest idle, ready for media.	Yes	Continue and verify with media, go to step 2.	
	No	Replace optical drive if continuous activity occurs with no disc installed.	J04
2. Insert known good data CD. Is media free to spin without optical drive scraping edge or surface of media? Verify disc does not exceed maximum thickness specification.	Yes	Continue and verify with media, go to step 3.	
	No	Internal mechanical interference is affecting rotational spin of media, replace optical drive.	J04
3. Initial disc handling noise is normal. Disc spinning and head seek indicate disc is mounting to desktop. Seek noise should settle down once mounted. Is noise above normal and related to seek activity?	Yes	Replace optical drive.	J04
	No	Go to step 4.	



4. Disc spin should cease 30 seconds after mounting data CD on OS desktop. Is the noise related to disc spin?	Yes	Go to step 5.	
	No	Go to step 6.	
5. Remove the optical drive and check for the correct seating of the brackets on the optical drive and in the top case. Reinstall drive in unit and retest. Verify if drive is still noisy.	Yes	Go to step 6.	
	No	Issue resolved. Optical drive was not properly mounted in enclosure. (Possible physical damage to optical drive.)	<b>(J05)</b>
6. Eject known good data CD. Disc handling noise should be one pop of disc from motor hub and a motor gear sound driving disc out of optical drive. Is noise above normal and related to disc eject activity or multiple eject attempts?	Yes	Replace optical drive.	<b>J02</b>
	No	Go to step 7.	
7. Disc spin should cease 30 seconds after mounting data CD on desktop. Media may be mounting on a defective internal spindle hub. Is the noise related to disc spin?	Yes	Replace optical drive.	<b>J04</b>
	No	Noise does not appear to be related to optical drive.	



## Optical Drive Not Performing to Specs

Unlikely cause: LCD, speakers, fan, camera, microphone

### Quick Check

Symptom	Quick Check
<b>Optical Drive Not Performing to Specs</b>  Read or write speeds slower than expected.	<ol style="list-style-type: none"><li>1. Test optical media in another drive of the same type in same type of computer to rule out media issue.</li><li>2. Check with known-good discs—Install discs that came with the computer.</li><li>3. For disc write issues, check with known-good media that performs well in another computer and drive of the same type.</li><li>4. Check both CD and DVD media. If only one type of media is producing errors, there might be a laser related issue. (J99)</li></ol>

### Deep Dive

Check	Result	Action	Code
1. Can optical drive read both CD and DVD known-good media?	Yes	Go to step 5	
	No	Reading CD only or DVD only indicates laser issue, replace optical drive.	<b>J03</b>
		Optical drive cannot read any media reliably. Go to step 2.	
2. Reseat cable connections at logic board and optical drive. Verify that media is now recognized and reads reliably.	Yes	Reseat resolved issue.	<b>X03</b>
	No	Go to step 3.	
3. Disconnect optical drive by lifting SATA cable at logic board and connecting a known-good drive. Verify that media is now recognized and reads reliably.	Yes	SATA port functional, reconnect user's optical drive & SATA cable. Go to step 4.	
	No	Replace logic board.	<b>M19</b>



4. Install and test with replacement optical drive SATA flex cable. Verify that media is now recognized and reads reliably.	Yes	Cable change resolved issue.	<b>X03</b>
	No	Replace optical drive. (Mechanical damage to optical drive, if found)	<b>J03 (J05)</b>
5. Test write data to compatible CD and DVD media. Verify burned media is recognized and reads reliably.	Yes	Issue resolved.	
	No	Replace optical drive. (Mechanical damage to optical drive, if found)	<b>J03 (J06)</b>

## Uncategorized Symptom

### Quick Check

Symptom	Quick Check
<b>Uncategorized Symptom</b>  Unable to locate appropriate symptom code	Verify whether existing symptom code applies to the issue reported by the user. If not, document reported symptom and send feedback to <a href="mailto:smfeedback@apple.com">smfeedback@apple.com</a> stating that a suitable symptom code could not be found.



# Input/Output Devices

## USB Port Does Not Recognize Known Devices

Unlikely cause: LCD, hard drive, optical drive

### Quick Check

Symptom	Quick Check
<b>USB Port Does Not Recognize Known Devices</b> USB-wired keyboard/mouse or USB flash drive not recognized	<ol style="list-style-type: none"><li>1. Check the for latest software update.</li><li>2. Use Apple System Profiler to verify the computer recognizes the USB bus.</li><li>3. Test port with known good Apple keyboard or mouse.</li><li>4. Verify any USB hubs have sufficient power.</li></ol>

### Deep Dive

Check	Result	Action	Code
1. Reset SMC and clear PRAM. Was USB device recognized?	Yes	Issue resolved.	
	No	Go to step 2.	
2. Is USB device receiving power from USB port? Note: first device to need >500ma will get 1000ma, all others are limited to <500ma.	Yes	Go to step 3.	
	No	Replace logic board.	<b>M15</b>
3. Is the latest Mac-compatible USB software driver for this USB device installed?	Yes	Replace logic board.	<b>M15</b>
	No	Obtain Mac-compatible USB driver.	





## Built-in Keyboard Does Not Work Properly

Unlikely cause: LCD, hard drive, optical drive

### Quick Check

Symptom	Quick Check
<b>Built-in Keyboard Does Not Work Properly</b> <ul style="list-style-type: none"><li>• Keystrokes not recognized</li><li>• Locks up</li><li>• Displayed characters don't match</li></ul>	<ol style="list-style-type: none"><li>1. In System Preferences: International: Input Menu, enable Keyboard Viewer. Select Show Keyboard Viewer from the Input Menu in the menu bar. Test the keyboard.</li><li>2. Confirm correct keyboard layout is selected.</li><li>3. Update to the latest system software.</li><li>4. Press Caps Lock, if the Caps Lock light goes on to show at least a partial connection to the main logic board.</li><li>5. Start up in Safe Mode to eliminate software that could affect the keyboard.</li></ol>

### Deep Dive

Check	Result	Action	Code
1. If specific keys are not working, confirm if they are physically broken.	Yes	Refer to <a href="#">“MacBook/ MacBook Pro: Black Keycap Replacement” (HT4002)</a> or <a href="#">“MacBook: White Keycap Replacement” (HT4003)</a> . If a keycap kit is available for this model, order kit and replace affected key(s).  Go to step 4.  If a keycap kit is not available for this model, replace complete top case.  Go to step 4.	K01
	No	Go to step 2.	
2. Reseat keyboard flex cable to logic board and verify that all keys are functional.	Yes	Issue resolved.	X99
	No	Go to step 3.	



3. Disconnect and verify that keyboard flex cable is in good condition (no delamination or torn cable end, no missing or cracked tracks).	Yes	Go to step 4.	
	No	Replace top case. Go to step 5.	<b>K01</b>
4. Reseat cable and check that flex cable end is fully inserted and aligned with connector on logic board, and that connector lock is closed. Verify that keyboard now functions properly. Reseat cable and verify with ASD that all keys are functional.	Yes	Issue resolved.	<b>K01</b>
	No	Replace top case. Go to step 5.	
5. Verify that all keys are functional using ASD.	Yes	Issue resolved.	<b>K01</b>
	No	Replace logic board.	<b>M15</b>

## Specific Keys Don't Work

Unlikely cause: power adapter, battery, speakers, display assembly, optical drive, hard drive, fan, microphone

### Quick Check

Symptom	Quick Check
<b>Specific Keys Don't Work</b> <ul style="list-style-type: none"> <li>• Keycap broken</li> <li>• Key switch broken</li> <li>• Sticky key</li> <li>• Key pressed not recognized</li> </ul>	<ol style="list-style-type: none"> <li>1. Determine if damage caused by user/technician environment, accidental damage, or abuse.</li> <li>2. Inform user/technician the failures are not covered by Apple warranties. Refer to <a href="http://www.apple.com/legal/warranty">http://www.apple.com/legal/warranty</a></li> <li>3. Inspect keycap to remove debris trapped under it.</li> <li>4. If the keycap is loose, check if clasp is still intact and reattach it.</li> <li>5. Refer to <a href="#">"MacBook/MacBook Pro: Black Keycap Replacement" (HT4002)</a> or <a href="#">"MacBook: White Keycap Replacement" (HT4003)</a>. If a keycap kit is available for this model, order kit and replace affected key(s). If a kit is not available, replace complete top case (code <b>K01</b>).</li> </ol>



## Built-in Trackpad Does Not Work

### Quick Check

Symptom	Quick Check
<b>Built-in Trackpad Does Not Work</b> <ul style="list-style-type: none"><li>Cursor does not move.</li><li>Select button of trackpad inoperable</li><li>Multiple touch features inoperable</li></ul>	<ol style="list-style-type: none"><li>Check for environmental factors such as humidity, hand lotion or jewelry. Check if user is touching the trackpad simultaneously with both hands.</li><li>Clean the trackpad surface (with the computer powered off) using a clean, dry, lint-free cloth.</li><li>Make sure all software and firmware updates have been applied.</li></ol>

### Deep Dive

Check	Result	Action	Code
1. Can you see the trackpad continuously listed on USB in Apple System Profiler?	Yes	Go to step 5.	
	No	Go to step 2.	
2. Does trackpad look damaged? Verify trackpad alignment is proper and click-depth set screw is at factory setting.	Yes	Replace trackpad according to symptom found. <ul style="list-style-type: none"><li>- No mouse/trackpad response</li><li>- Trackpad cursor not tracking properly</li><li>- Trackpad button issues</li></ul> Go to step 6.	<b>K02</b> <b>K12</b> <b>K13</b>
	No	Go to step 3.	
3. Reseat the trackpad flex cable to the logic board. Does trackpad work now?	Yes	Loose cable. Issue resolved.	
	No	Go to step 4.	
4. Is the trackpad connector on the logic board damaged?	Yes	Replace logic board.	<b>M24</b>
	No	Go to step 5.	
5. In System Preferences: Universal Access, turn off special Keyboard and Mouse & Trackpad settings. Set for normal use, enable and test multiple touch features. Does trackpad work now?	Yes	Settings issue resolved.	
	No	Go to step 6	



6. Does the select button click? Verify trackpad alignment is proper and click-depth set screw is at factory setting.	Yes	All trackpad issues resolved.	
	No	Go to step 7	
7. Does a known-good trackpad work?	Yes	Replace trackpad according to symptom found. - No mouse/trackpad response - Trackpad cursor not tracking properly - Trackpad button issues	K02 K12 K13
	No	Replace logic board.	M16

## Built-in Keyboard Has Dim or No Keyboard Backlight

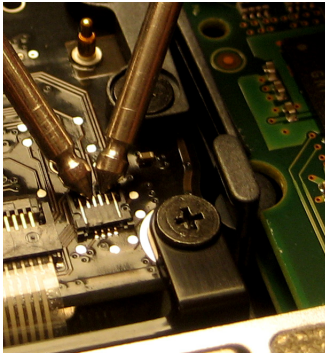
Unlikely cause: LCD, hard drive, optical drive

### Quick Check

Symptom	Quick Check
<b>Built-in Keyboard Has Dim or No Backlight</b> <ul style="list-style-type: none"><li>In darkened room, keyboard backlight does not come on or is dim.</li></ul>	<ol style="list-style-type: none"><li>Make sure this computer model has a keyboard backlight option by checking the configuration label in the battery bay.</li><li>Make sure that keyboard backlight is turned on and brightness turned up.</li><li>Block the ambient light sensor to simulate darkened room.</li></ol>

### Deep Dive

Check	Result	Action	Code
1. Cover the ambient light sensor, located near camera. Did the display dim?	Yes	Ambient light sensor is working. Go to step 4.	
	No	Go to step 2.	
2. Cover the ambient light sensor again. Did the keyboard backlight work?	Yes	Issue resolved.	
	No	Go to step 3.	



3. Measure the voltage between pin 4 and pin 2 of the keyboard backlight connector J5815. Is there voltage present with the running system in a dark room?	Yes	Replace top case.	<b>K10</b>
	No	Go to step 4.	
4. Reseat the keyboard backlight connection to the logic board. Does the keyboard backlight work now?	Yes	Issue resolved.	
	No	Go to step 5	
5. In the Apple System Profiler, can you see the AirPort and Bluetooth cards?	Yes	The light sensor connection to logic board is likely good. Replace display assembly	<b>L14</b>
	No	Replace logic board.	<b>M99</b>

## Built-in Keyboard Is Not Recognized

Unlikely cause: LCD, hard drive, optical drive

### Quick Check

Symptom	Quick Check
<b>Built-in Keyboard Is Not Recognized</b> <ul style="list-style-type: none"><li>Keystrokes not recognized</li></ul>	<ol style="list-style-type: none"><li>Reset SMC.</li><li>Press Caps Lock. If the Caps Lock light comes on that indicates at least a partial connection to the logic board.</li><li>In System Preferences: International: Input Menu, enable Keyboard Viewer. Select Show Keyboard Viewer from the Input Menu in the menu bar. Test the keyboard.</li></ol>

### Deep Dive

Check	Result	Action	Code
1. In Apple System Profiler do you see "Apple Internal Keyboard/Trackpad" listed under USB hardware devices?	Yes	Go to step 3.	
	No	Go to step 2.	



2. Reset SMC and verify if keyboard/trackpad is now seen in Apple System Profiler.	Yes	Go to step 3.	
	No	Replace logic board.	M15
3. Disconnect and verify that keyboard flex cable is in good condition (no delamination or torn cable end, no missing or cracked tracks).	Yes	Go to step 4.	
	No	Replace top case. Go to step 5.	K11
4. Reseat cable and check that flex cable end is fully inserted and aligned with connector on logic board, and that connector lock is closed. Verify that keyboard now functions properly.	Yes	Issue resolved.	
	No	Replace top case. Go to step 5.	K11
5. Verify that all keys are functional using ASD.	Yes	Issue resolved.	
	No	Replace logic board.	M15

## Built-in Trackpad Does Not Track Properly

Unlikely cause: LCD, hard drive, optical drive

### Quick Check

Symptom	Quick Check
<b>Built-in Trackpad Does Not Track Properly</b> <ul style="list-style-type: none"><li>Cursor movement is random, uneven, or jumpy.</li><li>Cursor hangs or stalls along path.</li></ul>	<ol style="list-style-type: none"><li>Check for environmental factors such as humidity, hand lotion or jewelry. Check if user is touching the trackpad simultaneously with both hands.</li><li>Clean the trackpad surface (with the computer off) using a clean, dry, lint free cloth.</li><li>Make sure all software and firmware updates have been applied.</li><li>If the issue occurs when system is running from the power adapter, use a grounded power cord with the power adapter.</li></ol>



## Deep Dive

Check	Result	Action	Code
1. Can you see the trackpad continuously listed under USB in Apple System Profiler?	Yes	Trackpad communicating to system. Go to step 5.	
	No	Go to step 2	
2. Does the trackpad look damaged?	Yes	Replace trackpad. Go to step 6.	K02
	No	Go to step 3.	
3. Reseat the trackpad flex cable on the logic board. Does the trackpad work now?	Yes	Loose cable. Issue resolved.	
	No	Go to step 4.	
4. Is the trackpad connector on the logic board damaged?	Yes	Replace logic board.	M24
	No	Go to step 5.	
5. In System Preferences: Universal Access, turn off special Keyboard and Mouse & Trackpad settings. Does trackpad work now?	Yes	Settings issue resolved.	
	No	Go to step 6.	
6. Does a known-good trackpad work?	Yes	Replace trackpad according to symptom found. - No mouse/trackpad response - Trackpad cursor not tracking properly - Trackpad button issues.	K02 K12 K13
	No	Replace logic board.	M16



## Apple Remote Inoperable

Unlikely cause: LCD, hard drive, optical drive

### Quick Check

Symptom	Quick Check
<b>Apple Remote Inoperable</b> <ul style="list-style-type: none"><li>Remote is not recognized.</li></ul>	<ol style="list-style-type: none"><li>The computer is on and awake.</li><li>Check with known-good remote on user's computer and the user's remote on known-good computer</li><li>Remote is used within 30 feet of the computer and unobstructed line-of-sight to the IR window.</li><li>Clean the IR window.</li><li>Open System Preferences: Security pane. Verify that "Disable remote control infrared receiver" is not checked.</li><li>In Security pane, if "Unpair" button is active, press it and pair the Apple Remote. See "Pairing your Apple Remote with your computer" (<a href="#">Knowledge Base HT1619</a>).</li></ol>

### Deep Dive

Check	Result	Action	Code
1. Open Photo Booth or iChat's Video Preview window. Point Apple Remote at the built-in iSight camera, press any button on the remote, and verify that (as seen through the camera) there is a faint blinking light on the remote.	Yes	Apple Remote is working. Go to step 2.	
	No	Replace the remote's battery. Go to step 2.	
2. Verify that you can pair the Apple Remote with a known-good system?	Yes	Go to step 3.	
	No	Replace the Apple Remote. Go to step 3.	<b>X04</b>
3. Verify that Apple Remote now works.	Yes	Issue resolved.	
	No	Check and reseat IR/sleep LED board cable connection at logic board. Go to step 4.	





4. Does the Apple Remote now work?	Yes	Issue resolved.	
	No	Replace the hard drive front bracket (includes IR/sleep cable). Go to step 5.	
5. Does the Apple Remote now work?	Yes	Issue resolved.	<b>K99</b>
	No	Replace logic board.	<b>M15</b>

## Built-in Speaker Has No Audio

Unlikely cause: LCD, hard drive, optical drive

### Quick Check

Symptom	Quick Check
<b>Built-in Speaker Has No Audio</b> Can't hear any audio from within the machine.	<ol style="list-style-type: none"><li>1. Make sure all software updates have been applied.</li><li>2. Check in System Preferences: Sound: Output that sound output is set to "Internal Speakers."</li><li>3. Use the F12 volume key to set the sound to maximum.</li><li>4. Reset PRAM.</li></ol>

### Deep Dive

Check	Result	Action	Code
1. Check System Preferences: Sound: Output and verify that no external speakers, "Digital Out," or headphones are being reported connected when there is none present.	Yes	Audio-out port is not damaged. Go to step 3.	
	No	Go to step 2	
2. With known-good headphone or speakers, plug in the audio output jack for several cycles. Verify that you get audio through external headphones/speakers when connected.	Yes	Go to step 4	
	No	Reseat the speaker connectors to logic board. Go to step 3.	



3. Verify that you now get audio through internal speakers .	Yes	Issue resolved.	
	No	Replace logic board.	<b>M09</b>
4. Disconnect known-good headphones or speakers. Verify that you now get audio through internal speakers.	Yes	Issue resolved.	
	No	Replace affected speaker(s).	<b>X08</b>

## Distorted Sound from Internal Speaker

Unlikely cause: LCD, hard drive, optical drive

### Quick Check

Symptom	Quick Check
<b>Distorted Sound from Internal Speaker</b> <ul style="list-style-type: none"><li>Distorted audio</li></ul>	<ol style="list-style-type: none"><li>Reset PRAM.</li><li>Adjust sound output and level in System Preferences: Sound: Output, and use the Balance to locate a left, right, or woofer speaker distortion source.</li><li>Compare the same sound and same settings against another unit to make sure the sound is actually distorting.</li></ol>

### Deep Dive

Check	Result	Action	Code
1. Comparing internal speakers with headphones, is the distortion on both headphones and speakers?	Yes	Audio source or gain issue. Reset PRAM, adjust sound level in System Preferences: Sound: Output, and retest with known-good audio source and external speakers. Go to step 5.	
	No	Internal speaker issue. Go to step 2.	



2. Use the Sound Output system preference to test the left and right speakers. If lower bass notes are distorted, right speaker/subwoofer may be defective. Are all speakers free of distortion, sounding clear and loud?.	Yes	Issue resolved.	
	No	Adjust volume to test full range of volume settings. Go to step 3.	
3. Is affected speaker cable properly inserted and free from damage?	Yes	Go to step 4.	
	No	Reseat speaker cable or replace damaged speaker. Go to step 5.	<b>X09</b>
4. Is affected speaker membrane free from dust or debris, and speaker membrane is not deformed/damaged?	Yes	Go to step 5.	
	No	Clean any dust or debris. Go to step 5. If membrane is damaged, replace the bad speaker(s).	<b>X09</b>
5. Verify that speaker enclosure is not damaged, correctly installed in system, and does not create unneeded vibration when sound is played.	Yes	Speaker housing and installation is good. Go to step 6.	
	No	Properly install or replace affected speaker. Go to step 6.	
6. Verify that internal speakers no longer produce distorted sound.	Yes	Issue resolved.	<b>X09</b>
	No	Replace logic board.	<b>M09</b>

## Uncategorized Symptom

### Quick Check

Symptom	Quick Check
<b>Uncategorized Symptom</b> Unable to locate appropriate symptom code	Verify whether existing symptom code applies to the issue reported by the user. If not, document reported symptom and send feedback to <a href="mailto:smfeedback@apple.com">smfeedback@apple.com</a> stating that a suitable symptom code could not be found.



# Mechanical Issues: Thermals and Enclosure

## Reset/Power Button Stuck

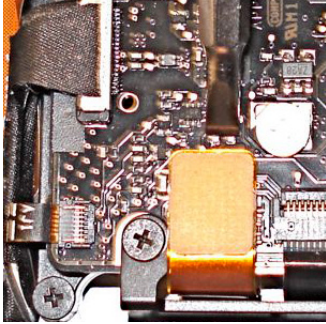
Unlikely cause: LCD, hard drive, optical drive

### Quick Check

Symptom	Quick Check
<b>Reset/Power Button Stuck</b> <ul style="list-style-type: none"><li>• System will not power on</li><li>• System sounds bootROM unlock tone during startup</li><li>• System automatically starts up repeatedly</li></ul>	<ol style="list-style-type: none"><li>1. Diagnose stuck button with SMC keyboard reset sequence</li><li>2. Inspect keyboard connection to logic board.</li><li>3. Try logic board power-on pads to determine open or closed power-on key. Closed circuit will not allow on-board switch to work.</li><li>4. If stuck down or closed, remove keyboard cable from logic board and try on board switch again to determine if top case is defective.</li><li>5. If logic board will not power on with keyboard cable removed, troubleshoot no power/no boot.</li></ol>

### Deep Dive

Check	Result	Action	Code
1. Reset SMC using keyboard 3 keys and power-on key. MagSafe LED can verify SMC reset. Momentary stop of battery charging will indicate SMC reset, orange LED will go green momentarily then return to orange.	Yes	Keyboard reset works while holding 3 keys and toggling power-on key, multiple press and release of power-on key works to show power-on key not stuck or fixed.	
	No	SMC keyboard reset not working, suggests power-on key is open circuit or stuck down. Go to step 2.	
2. Remove battery and AC power for 30 seconds to perform a manual SMC reset. Apply AC power. Does power-on key work when pressed?	Yes	SMC restored from power removal sequence. Power-on key now working properly.	
	No	Power-on key stuck or open. Go to step 3.	



<b>3.</b> Inspect keyboard flex cable for loose or damaged connections. Align and reseat to flex cable to ensure proper connections. Does power-on key now work correctly?	Yes	Cable reseat restored power-on key operation.	
	No	Power-on key still appears to be stuck or open. Go to step 4.	
<b>4.</b> Use conductive tool to assert power on by touching power-on switch pads (R5015, located just above trackpad connector) on logic board.	Yes	System powers on suggesting top case power on key circuit is open. Replace top case for open power-on key.	<b>X14</b>
	No	Power-on key circuit appears to be closed suggesting a stuck power-on key. Go to step 5.	
<b>5.</b> Disconnect the internal keyboard flex cable and assert power-on switch pads on logic board. Removing top case power-on key from circuit should free on-board switch to work properly.	Yes	On board power-on switch pads now starts the system. Replace top case due to stuck power-on key.	<b>X14</b>
	No	Go to M01: No power/ not booting	

## System Runs Hot

Unlikely cause: LCD, hard drive, optical drive

### Quick Check

Symptom	Quick Check
<b>System Runs Hot</b> <ul style="list-style-type: none"><li>System feels very warm</li><li>Fan(s) not working</li><li>Fan(s) are full on</li></ul>	<ol style="list-style-type: none"><li>1. Verify the computer operating on a flat, hard surface and the vents are not blocked.</li><li>2. Verify the computer is not running hotter than expected for normal operation. If possible, compare to a similarly configured computer.</li><li>3. Reset SMC.</li><li>4. Inspect fan performance</li><li>5. Run thermal sensor test.</li></ol>



## Deep Dive

Check	Result	Action	Code
1. Is the system running as expected (compared to similar system)?	Yes	Use “Apple Portables: Operating Temperature” ( <a href="#">Knowledge Base HT1778</a> ) to inform user it is operating normally.	
	No	Go to step 2.	
2. Are there runaway applications? See “Runaway applications can shorten battery run time” ( <a href="#">Knowledge Base TS1473</a> ).	Yes	Check with the vendor for compatibility and software update.	
	No	Go to step 3.	
3. Fans are typically on at minimum speed. Perform SMC reset or remove all power for 15 minutes. Is the fan(s) running properly?	Yes	Go to step 5.	
	No	Fan(s) not running or always running at full speed. Go to step 4.	
4. Reseat fan connection to logic board or test a known-good fan. Replace a fan that is not spinning or replace logic board that is not spinning a known-good fan. Is fan(s) working properly?	Yes	Reseating or replacing bad fan resolved issue. Replace logic board if it does not work with known-good fan.	<b>X99 or M18</b>
	No	Go to step 5.	
5. Is the heatsink installed properly with no damage to heat fins?	Yes	Go to step 7.	
	No	Replace missing screws or damaged heatsink. Go to step 6.	
6. Is the system running as expected?	Yes	Heatsink installed incorrectly. Issue resolved.	<b>X10</b>
	No	Go to step 7.	
7. Heatsink thermal grease possibly missing or improperly installed during previous repair?	Yes	Replace heatsink or install thermal grease.	<b>X10</b>
	No	Go to step 8.	



8. Inspect and reseal connections to thermal sensors throughout the system, run test for sensor monitoring.	Yes	Thermal module or other sensor reseal resolved issue.	<b>X99</b>
	No	Replace logic board if sensor error. Go to step 9.	
9. After logic board replacement, is the computer running as expected?	Yes	Bad logic board. Issue resolved.	<b>M23</b>
	No	Use minimum configuration troubleshooting to isolate the issue.	

## Clamshell does not stay closed when stored vertically

### Quick Check

Symptom	Quick Check
<b>Clamshell does not stay closed when computer is stored vertically</b> <ul style="list-style-type: none"><li>When stored in a bag, the clamshell pops up</li><li>Magnets don't hold the clamshell onto top case.</li></ul>	Verify whether clamshell edges are aligned with top case when closed, and that computer case does not seem to suffer from any physical damage.  If no damage is found, proceed with hinge alignment documented in the <a href="#">Additional Procedures</a> chapter.

## Uncategorized Symptom

### Quick Check

Symptom	Quick Check
<b>Uncategorized Symptom</b> Unable to locate appropriate symptom code	Verify whether existing symptom code applies to the issue reported by the user. If not, document reported symptom and send feedback to <a href="mailto:smfeedback@apple.com">smfeedback@apple.com</a> stating that a suitable symptom code could not be found.

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# **Apple Technician Guide**

## **Take Apart**

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### **MacBook (13-inch, Aluminum, Late 2008)**





# General Information

## Vertical Insertion (JST)

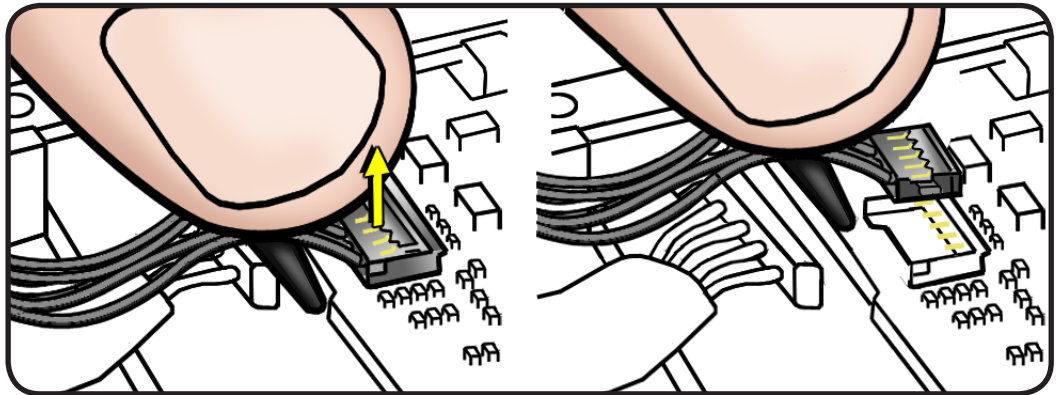
- Use black stick under cable to remove.
- Keep connector level to board when disconnecting and reconnecting.
- Press evenly when reconnecting or connector can tip up and not be fully seated.

Examples:

- fan cable
- battery indicator light cable
- heatsink sensor
- left speaker cable
- microphone cable (underside)

## Connector Types on Logic Board

On the logic board are six types of connectors, each requiring special handling. Make sure you read these tips before disconnecting and installing the connectors.

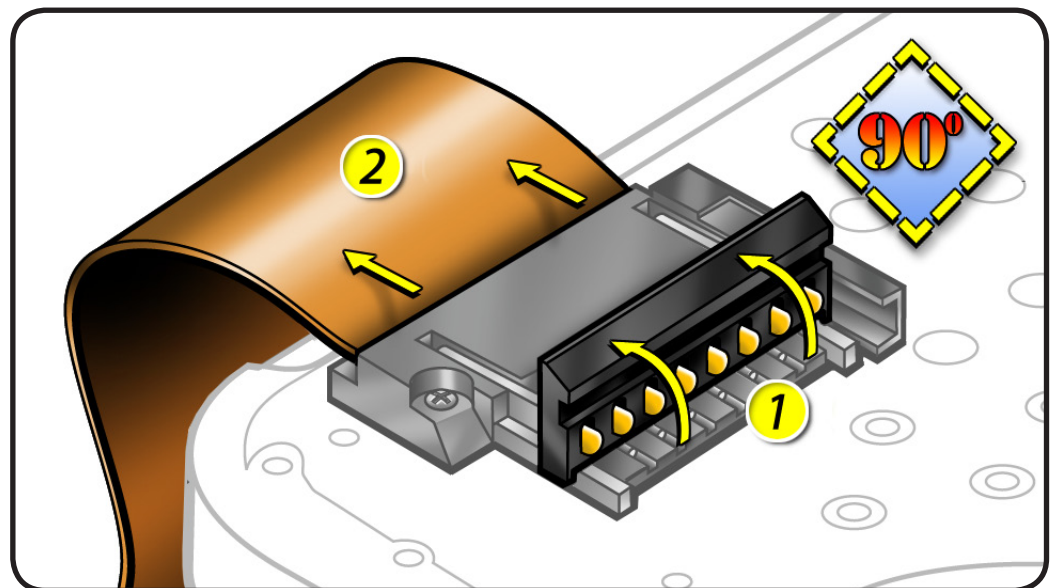


## Locking Lever

- Flip up lever 90 degrees for flex cable removal.
- Use plastic tweezers to hold cable.
- Slide cable into receptacle on same horizontal plane.
- Lock down lever after inserting cable.

Examples:

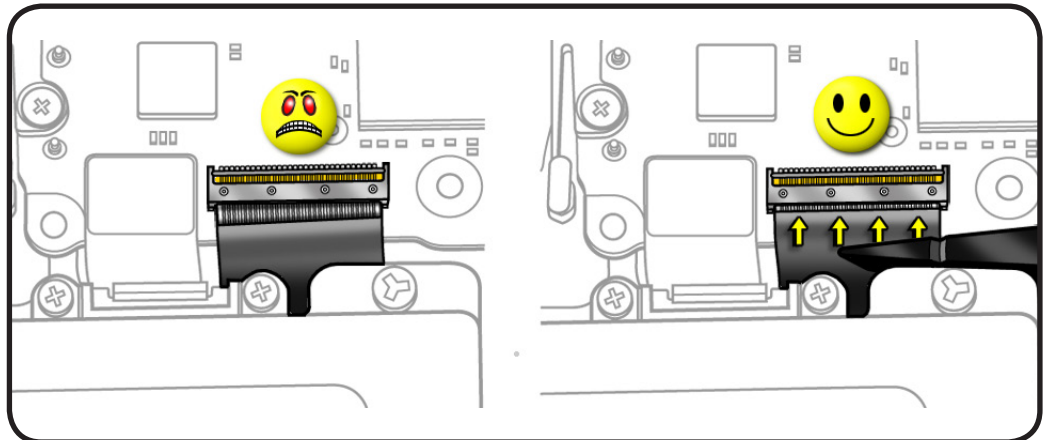
- IR/sleep cable
- backlight cable





- keyboard flex cable

**Caution:** Use black stick to push the keyboard flex cable **all the way** into connector to prevent “no power” symptoms.

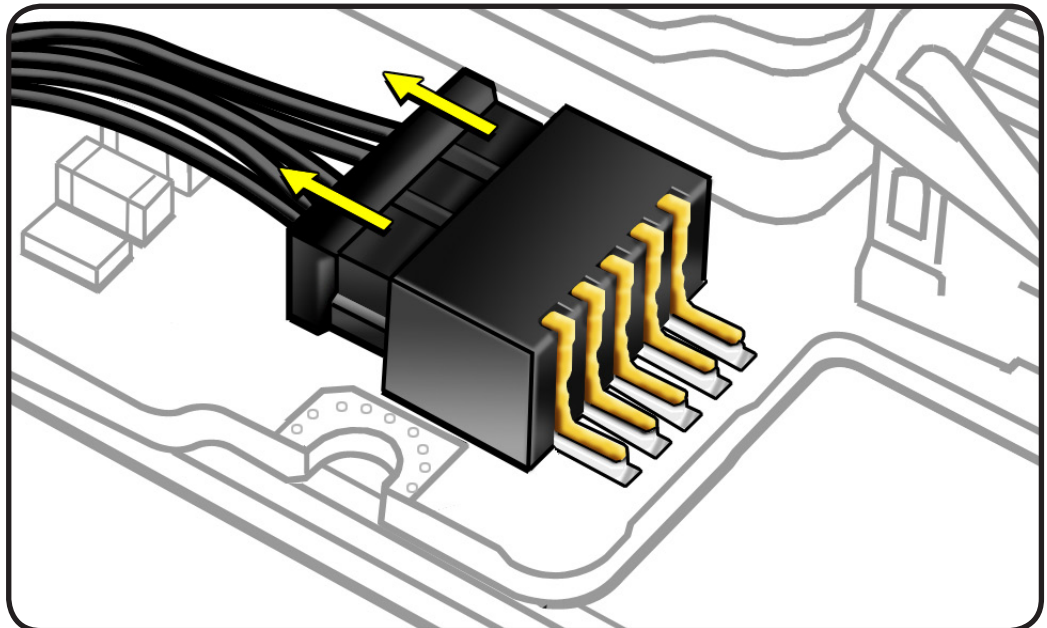


### Horizontal Install

- Pull connector, not cable, to remove.
- Slide connector into receptacle on same horizontal plane as board.

Examples:

- right speaker/subwoofer cable
- MagSafe cable on underside of board
- battery power cable on underside of board

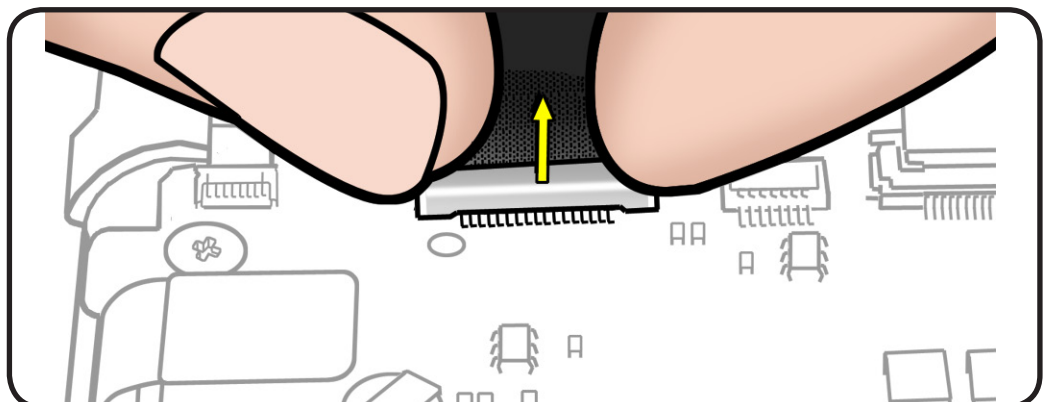


### Multi-Pin Vertical Insert

- Use fingernails to remove evenly.
- Insert connector parallel to board.

Examples:

- hard drive connector cable



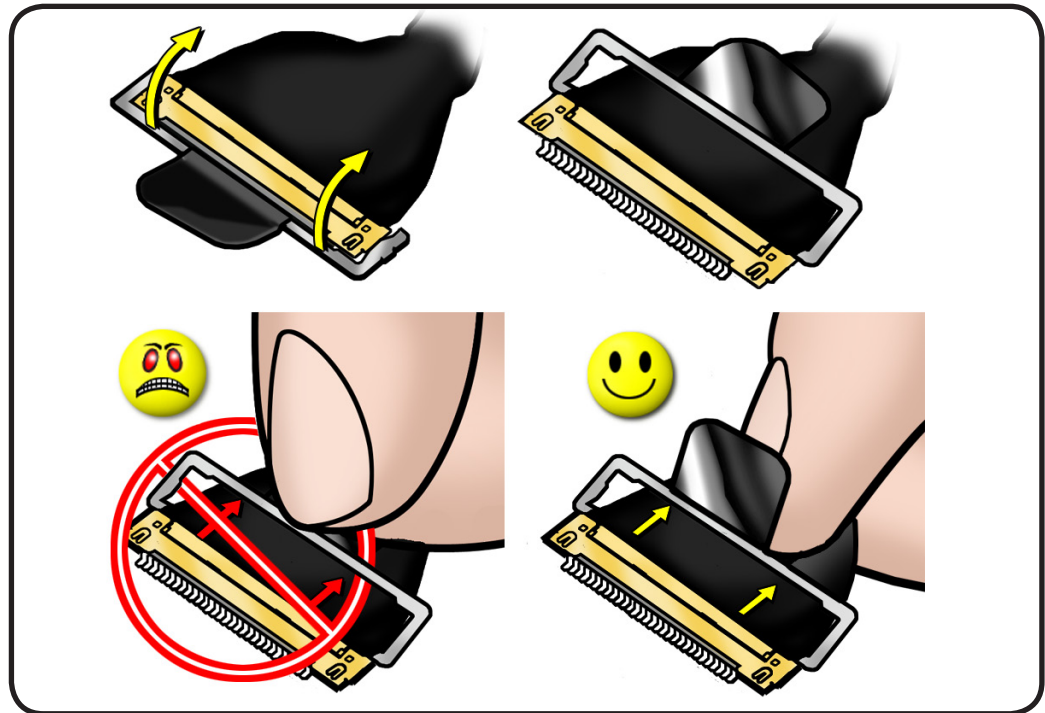


### Thin, Multi-Pin Horizontal Insert

- Flip up locking bar, if present.
- Use fingers or tweezers to slide out cable evenly on same horizontal plane.
- Grasp cable—not locking bar nor connector—to disconnect.
- Slide connector into receptacle on same horizontal plane as board.
- Reseat locking bar, if present to secure connector

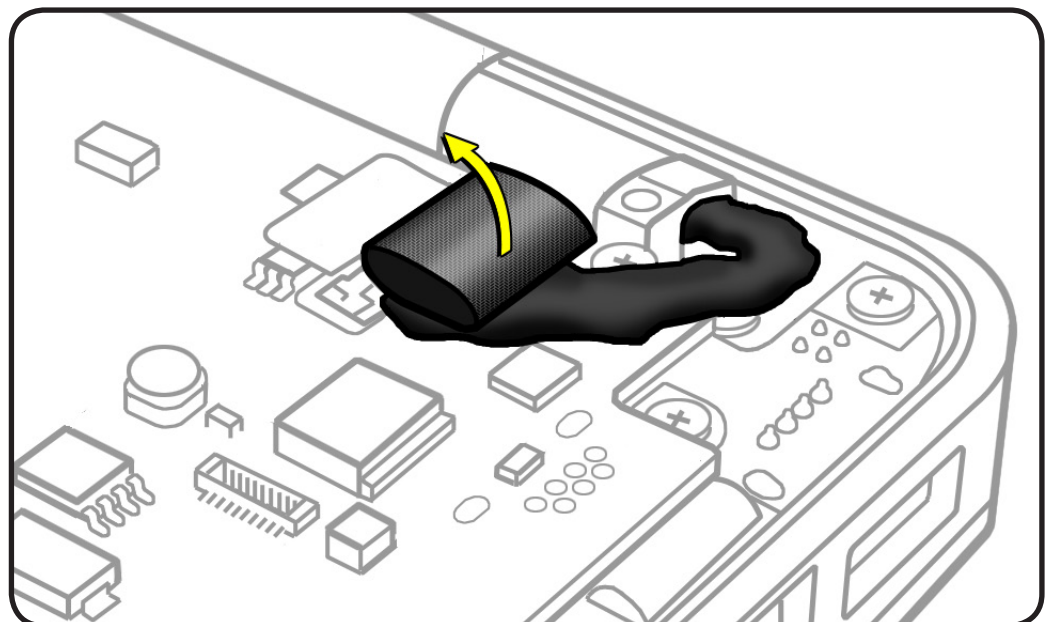
Examples:

- LVDS cable
- Camera cable



**Caution:** When removing the LVDS connector, first peel off foam gasket in the direction shown.

**Replacement Caution:** To prevent video “noise,” a whining sound, no video, or a short to the logic board, be sure to place foam gasket on connector—**positioned precisely where shown**—**after** cable is fully connected to logic board.



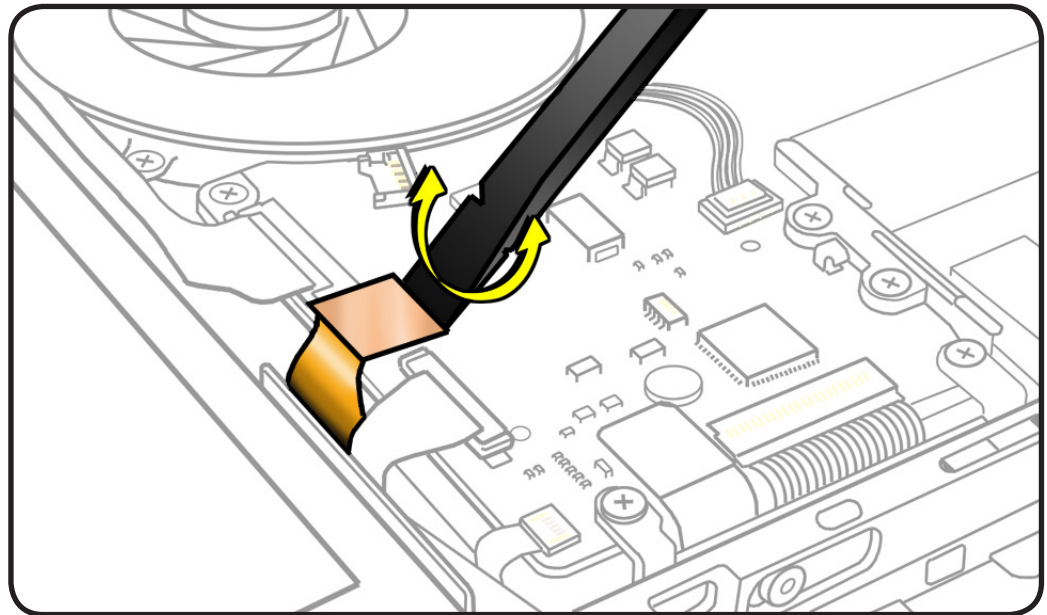


## Low-Profile Solid Platform Flex

- Use black stick and gentle rocking motion to release tension to remove cable.
- Keep connector level to board and press evenly on platform to install.

Examples:

- optical drive flex cable
- trackpad flex cable



## Icon Legend

The following icons are used in this chapter:

Icon	Meaning
	Warning or Caution
	Check mark; make sure you do this

## Temperature Concerns

The normal operating temperature of this computer is well within national and international safety standards. Nevertheless, customers may be concerned about the generated heat. To prevent an unneeded repair, you can compare a customer's computer to a running model, if available, at your repair site. For more information on temperature concerns and customer perception, refer to Knowledge Base article 30612 "Apple Portables: Operating Temperature."

<http://docs.info.apple.com/article.html?artnum=30612>

## Replacement Steps

When there are no replacement steps listed, replace parts in the exact reverse order of the Removal procedure.

## Screw Sizes

All screw sizes shown are approximate and represent the total length of the screw.



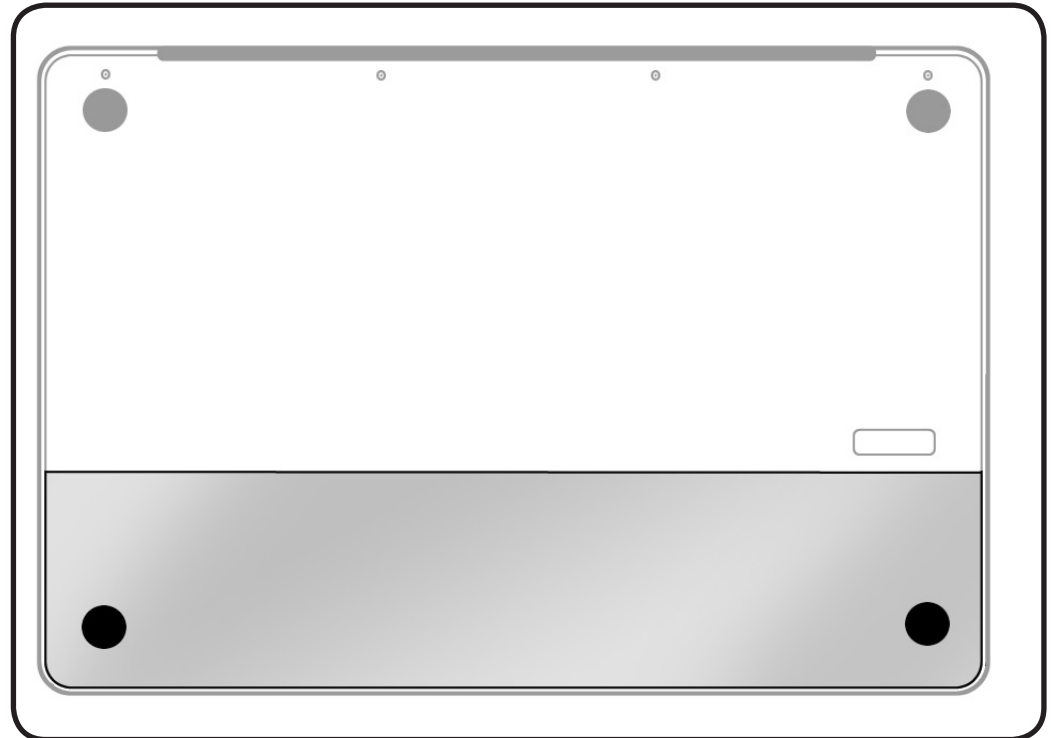
# Access Door

## First Steps:



Warning:

- Shut down computer.
- Wait 10 minutes
- Unplug all cables.
- Put on ESD strap.



## Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat

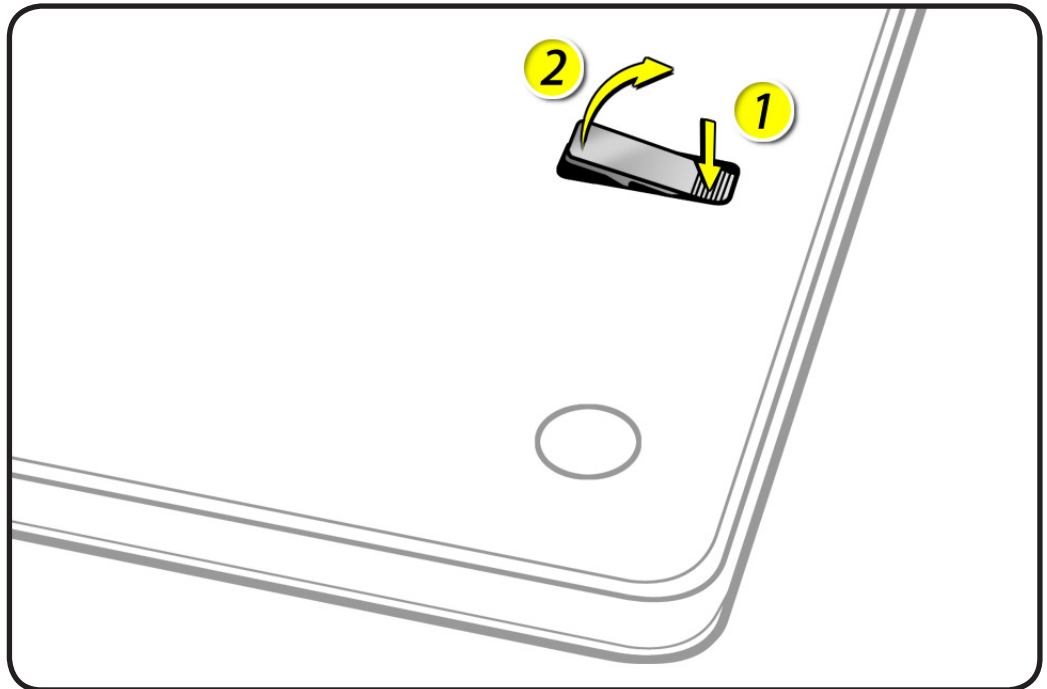




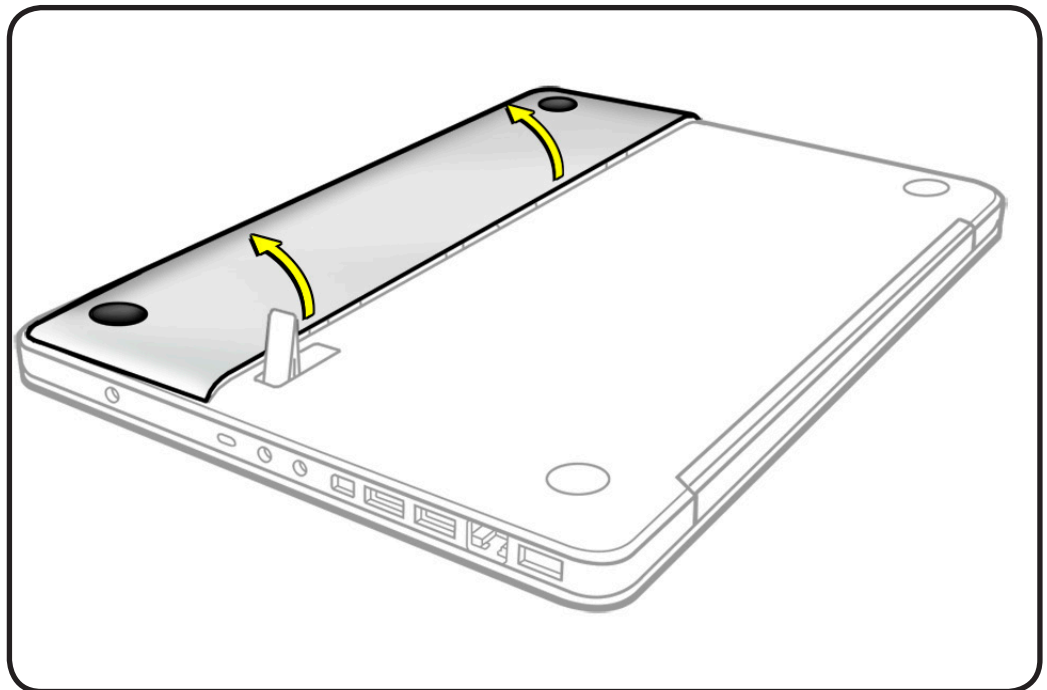


## Removal

- 1 Press locking lever.



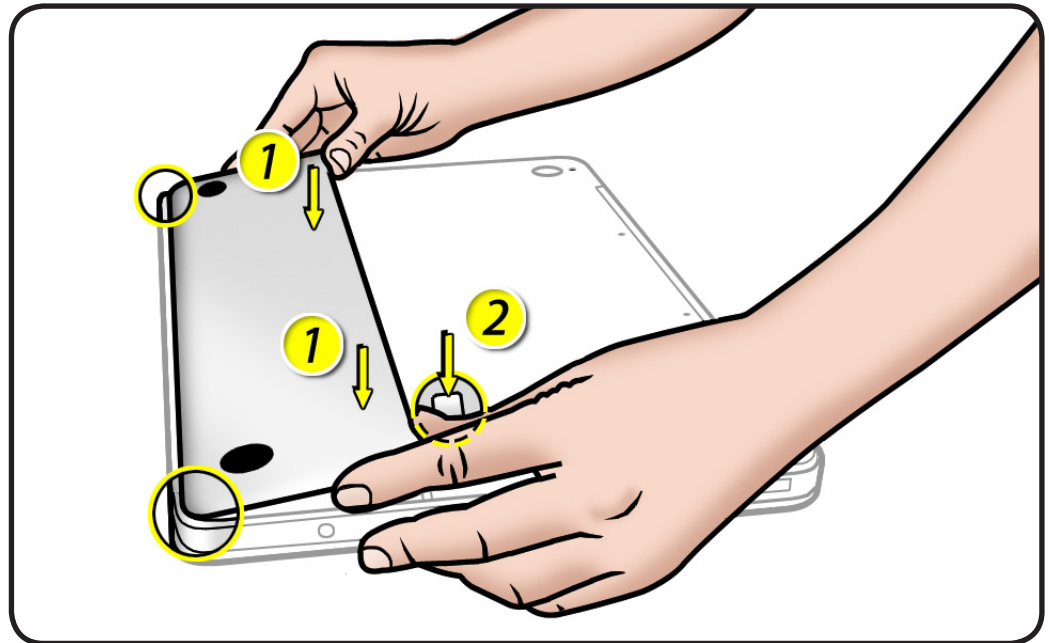
- 2 Lift off access door.





## Replacement

- 1** Attach front of door.
- 2** Align corners and close door.
- 3** Close locking lever.



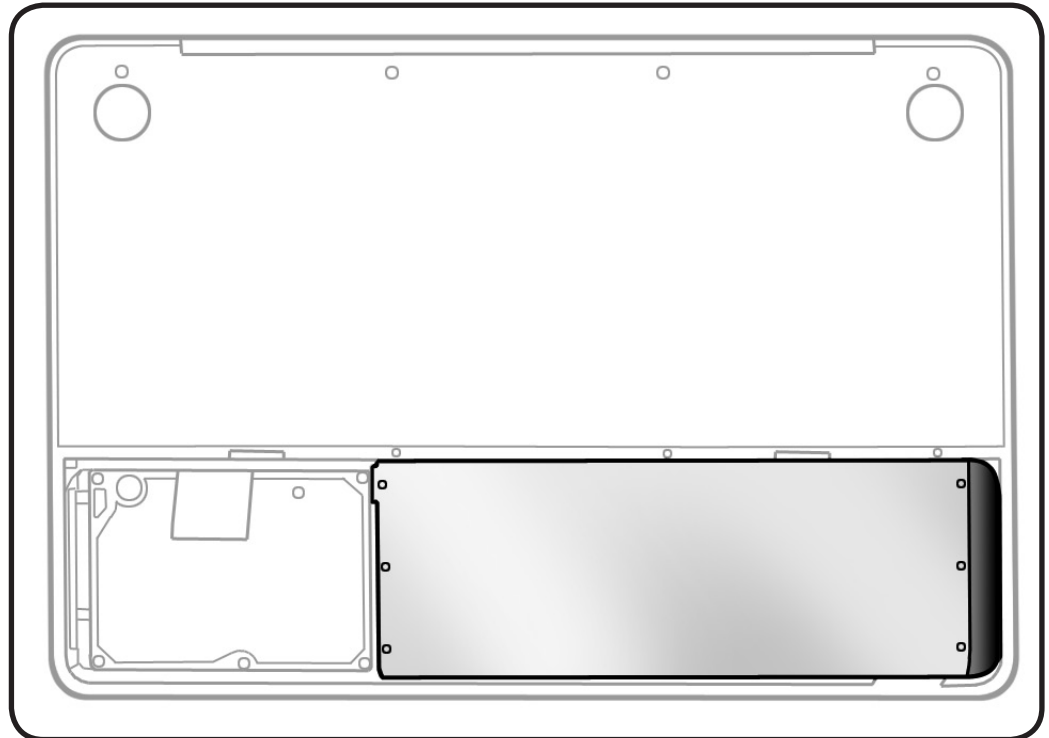


# Battery

## First Steps

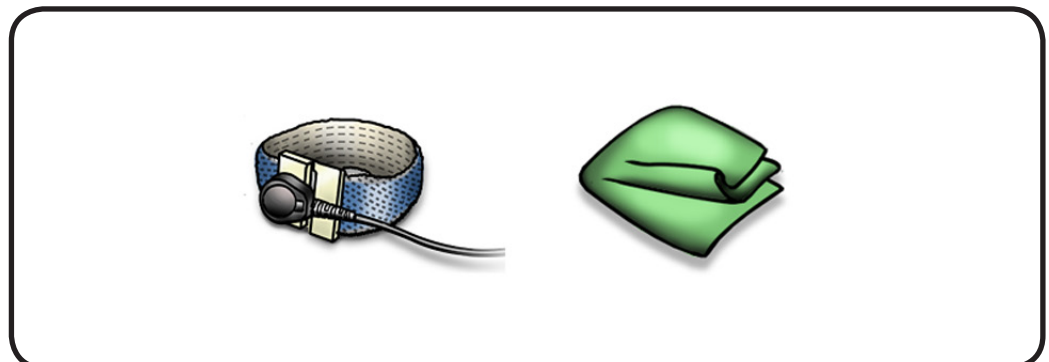
Remove:

- [Access door](#)



## Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat

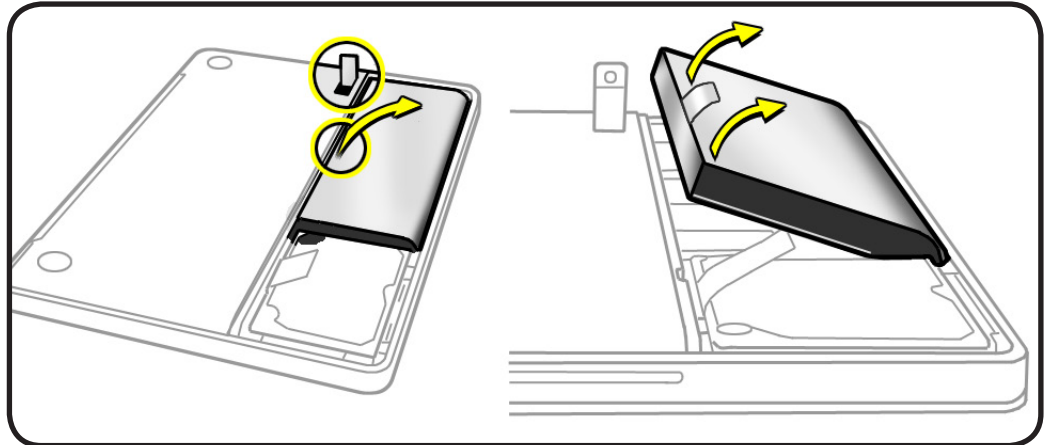






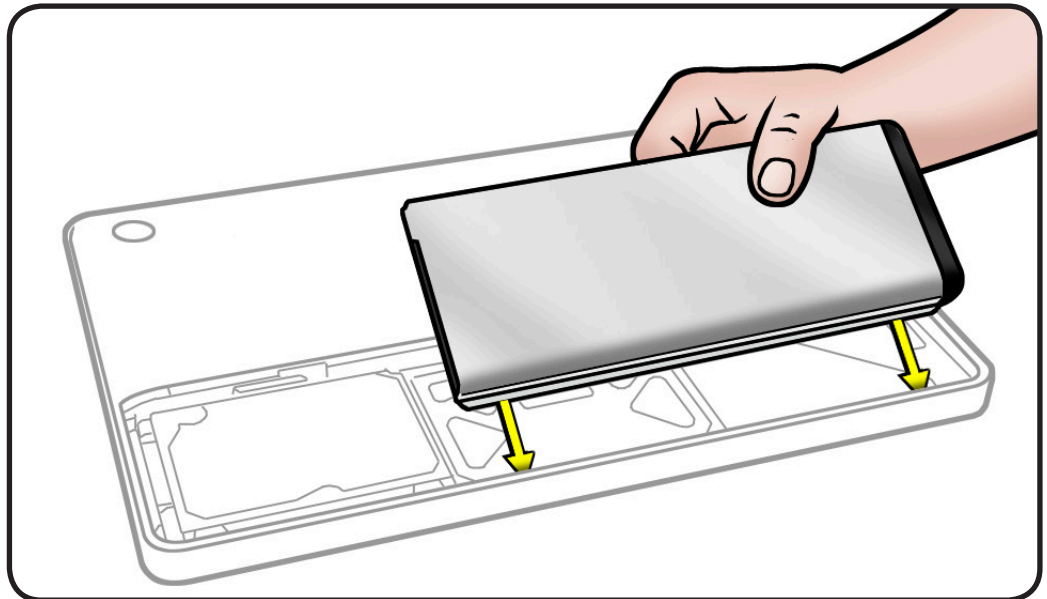
## Removal

- 1 Make sure locking lever is up.
- 2 Pull battery tab to remove battery.



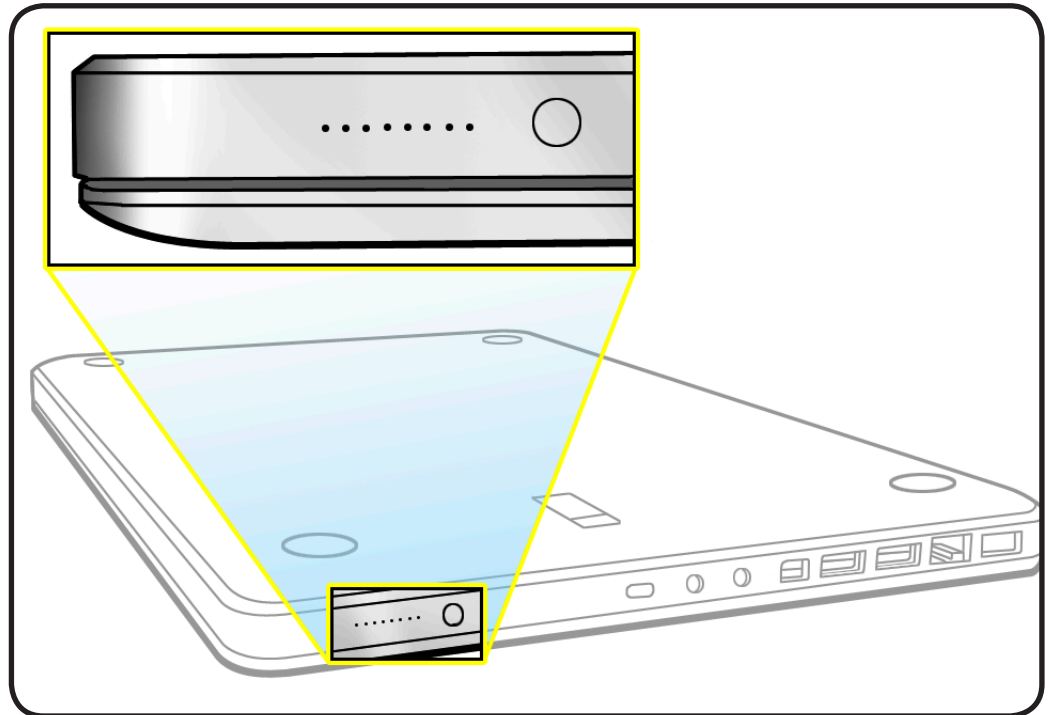
## Replacement

- 1 Insert beveled edge of battery into battery bay.  
**Note:** Make sure battery connector is well seated.
- 2 Reassemble computer.





- 3** Press battery button to check charge level.





# Hard Drive Bracket

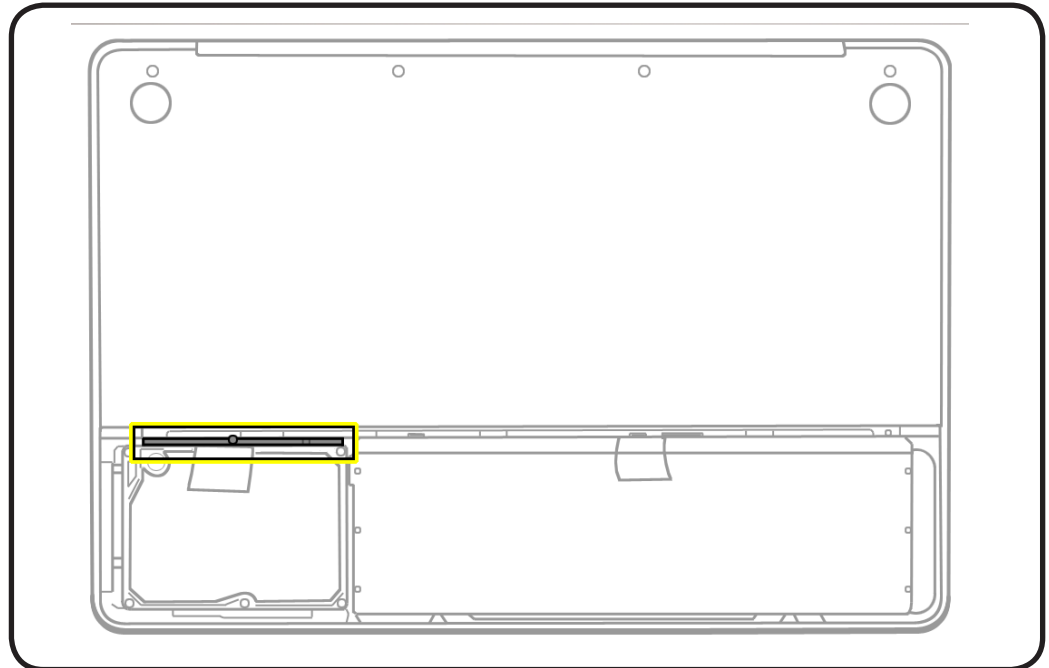
## First Steps

Remove:

- [Access door](#)
- [Battery](#)

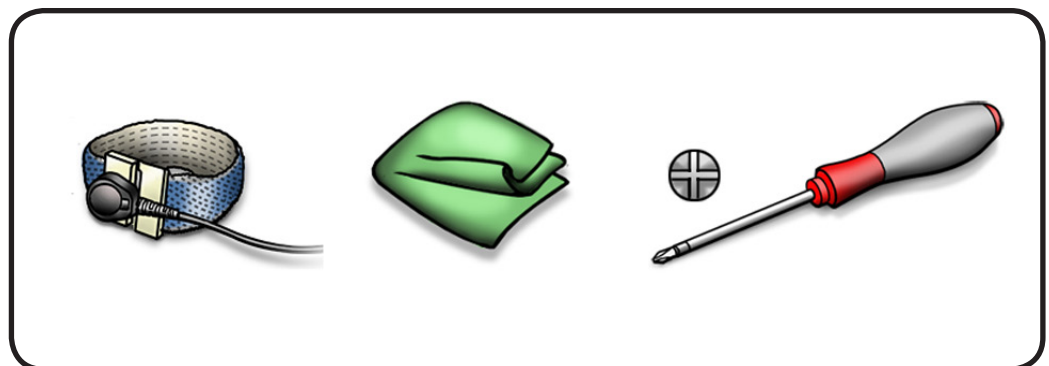


Caution: Make sure data is backed up before removing the hard drive.



## Tools

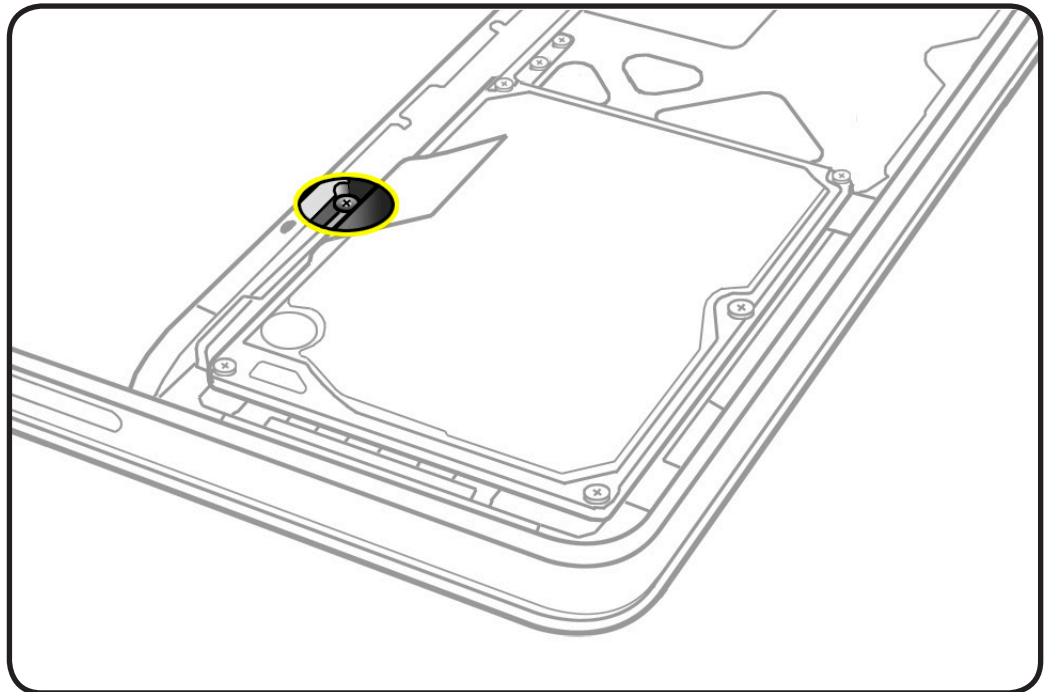
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver





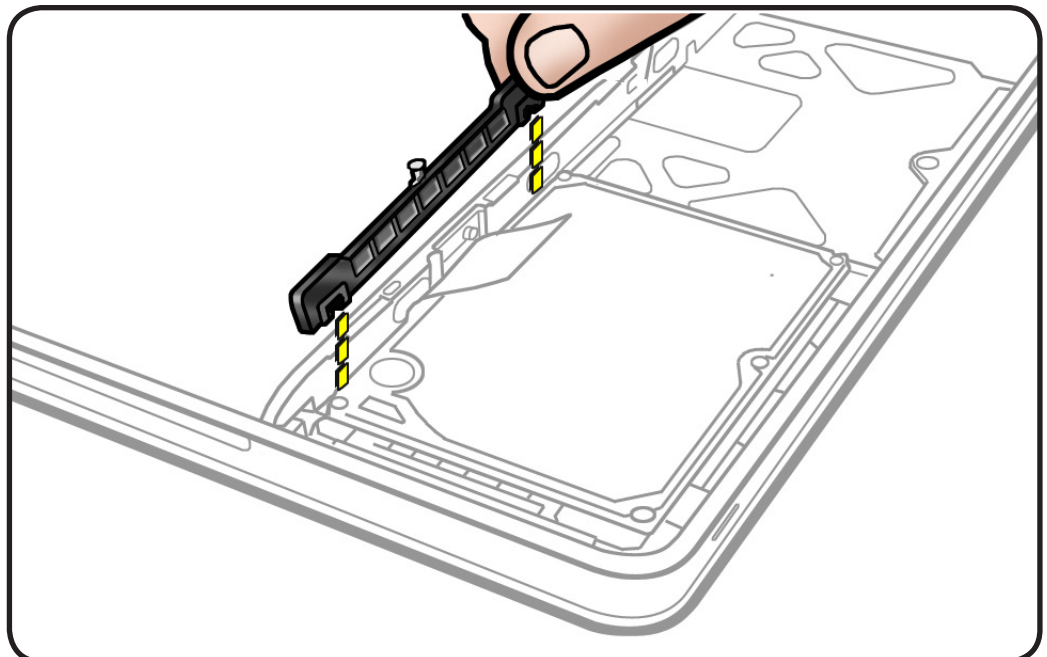
## Removal

- 1 Loosen 1 captive screw.



- 2 Lift out retaining bar.

**Replacement Note:** Make sure 2 rubber grommets are included in retaining bar before installing it.





# Hard Drive

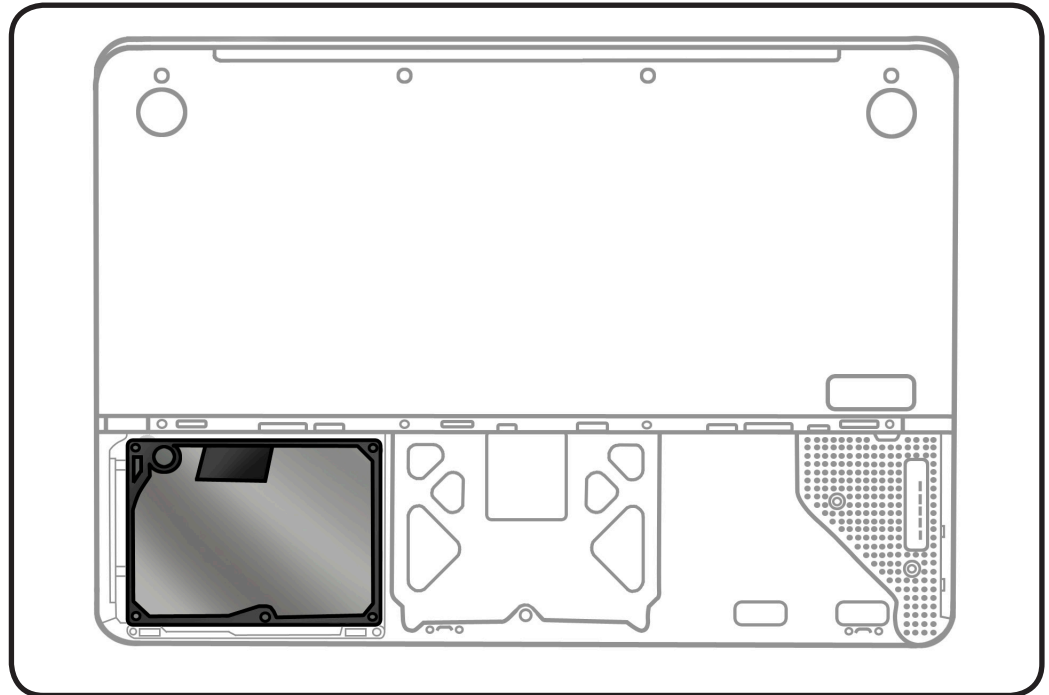
## First Steps

Remove:

- [Access door](#)
- [Battery](#)
- [Hard drive bracket](#)

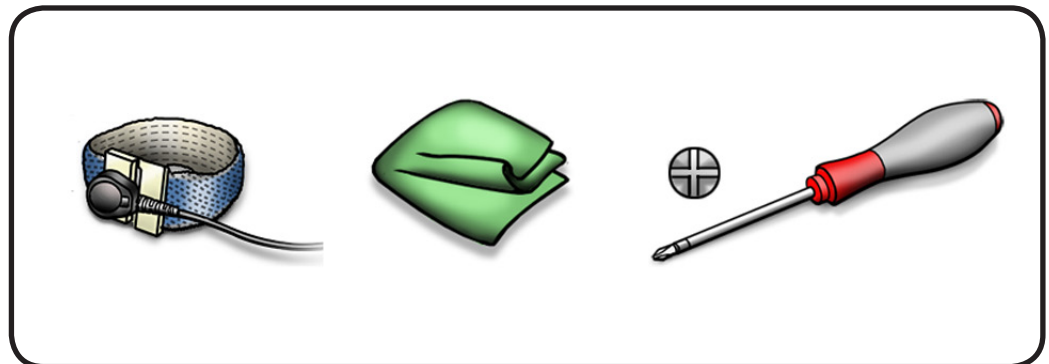


**Caution:** Make sure data is backed up before removing the hard drive.



## Tools

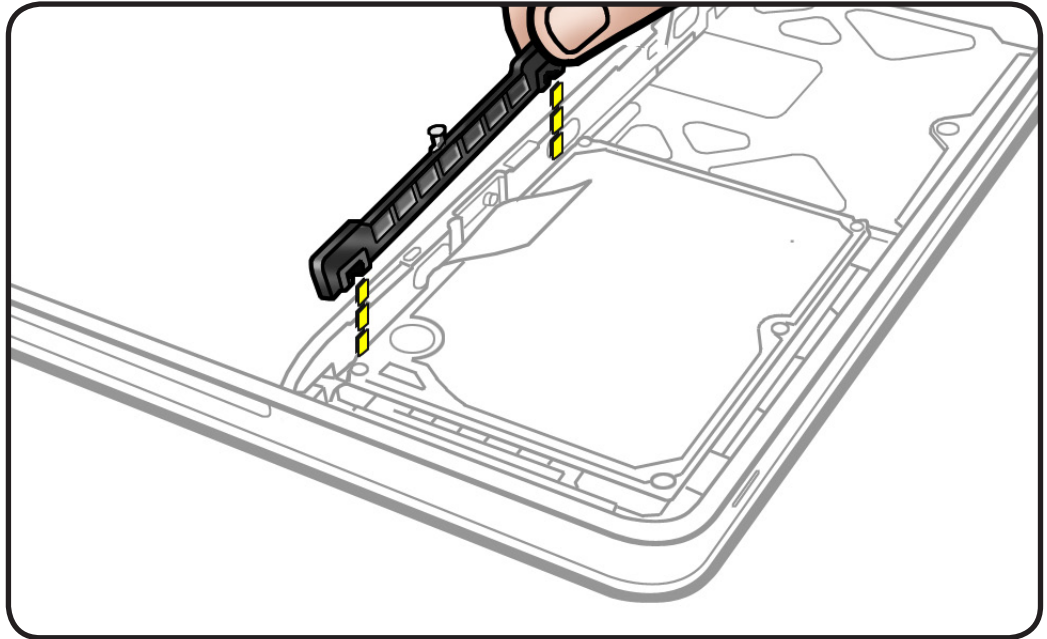
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver



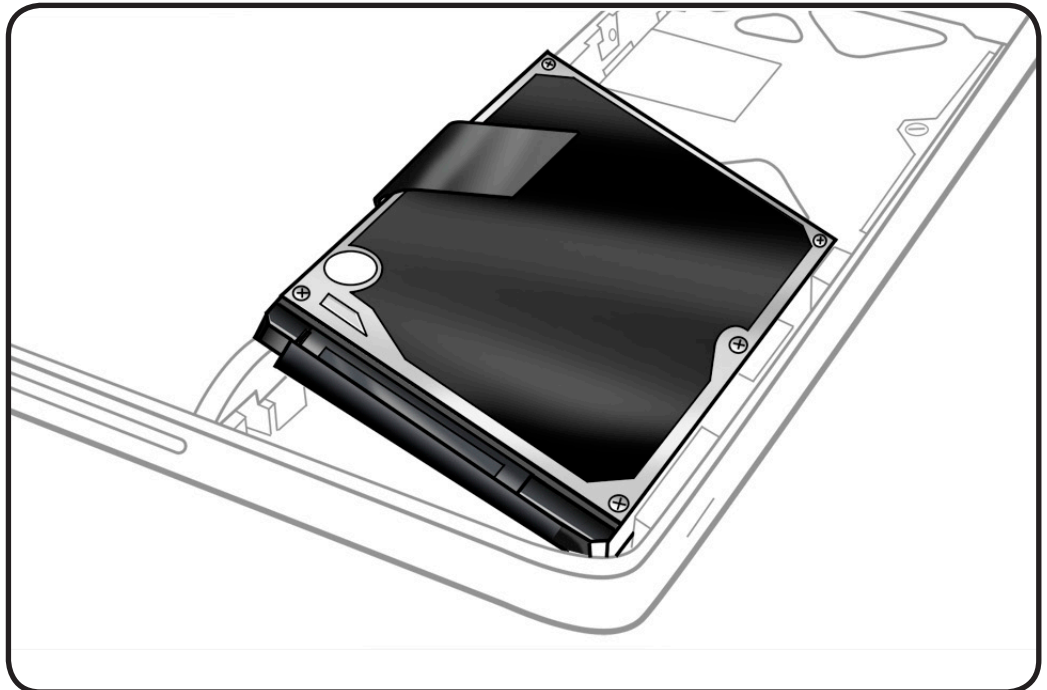


## Removal

- 1 Make sure hard drive bracket is removed.



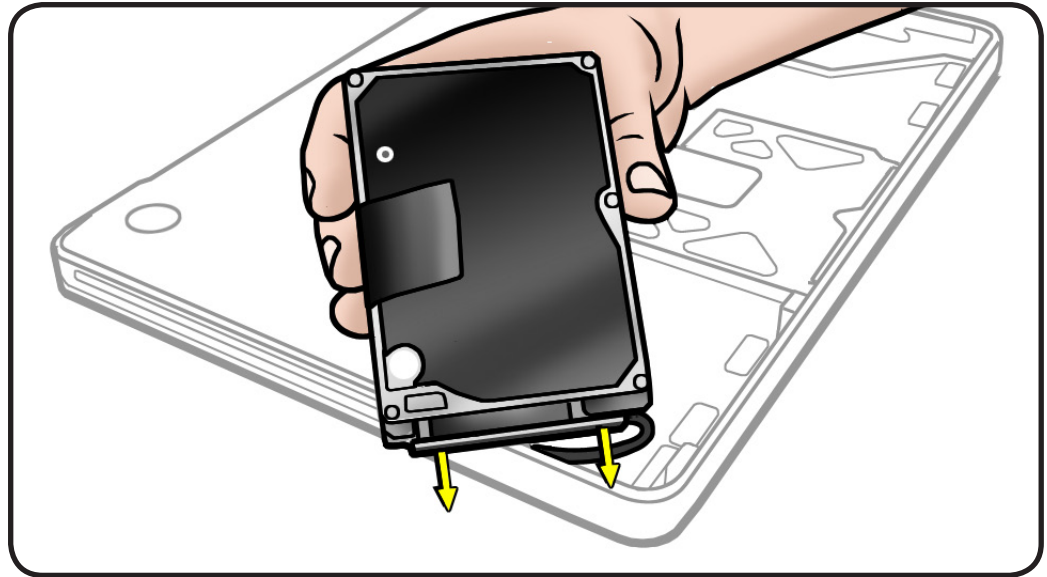
- 2 Use pull tab to tilt hard drive out.





**3** Hold hard drive by the sides only.

**4** Disconnect hard drive connector.

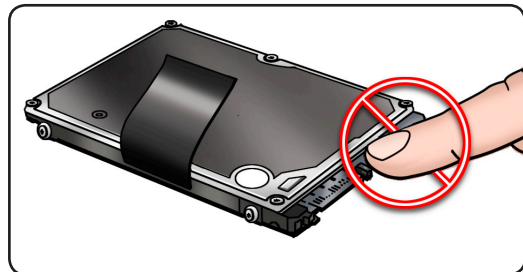


**5** Follow safe handling:

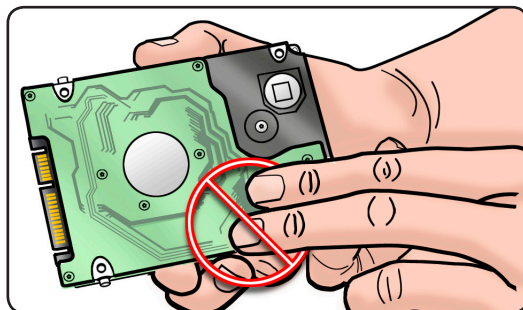
- Do not press drive



- Do not touch connector



- Do not touch circuitry

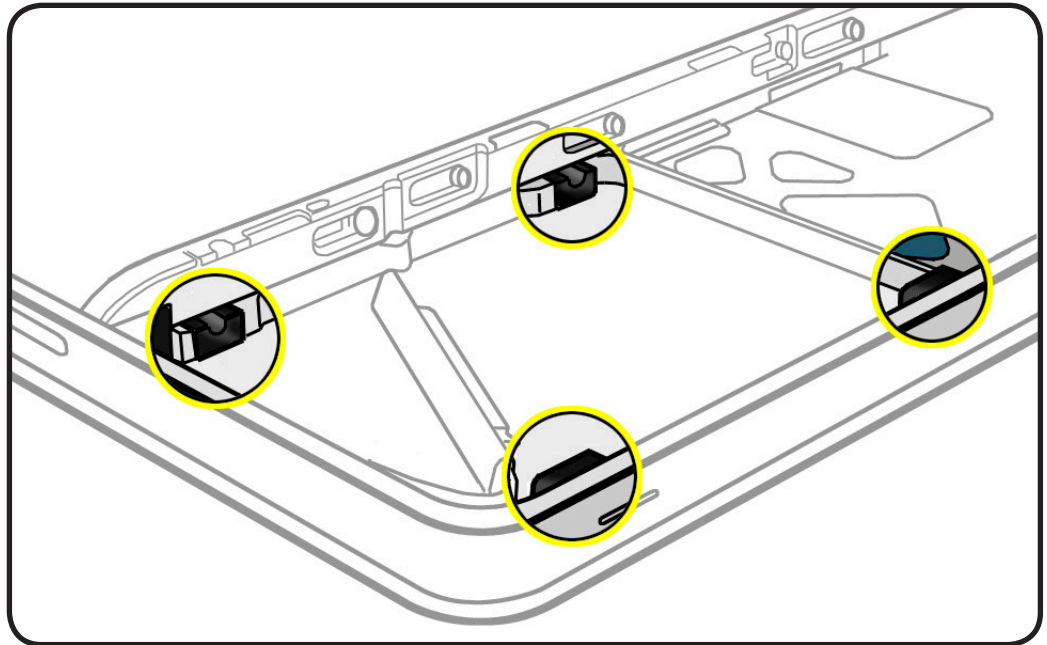




## Replacement

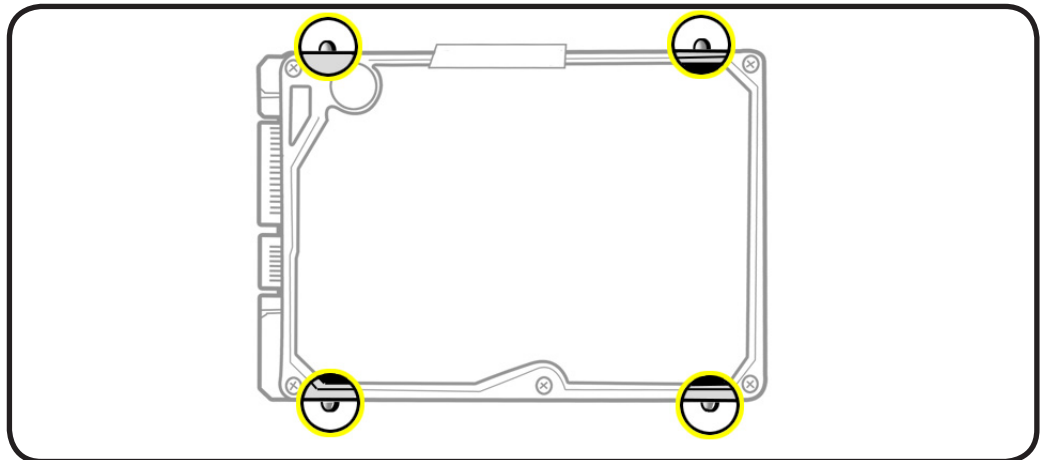
- 1 Make sure 4 rubber grommets are included in top case before installing the hard drive.

**Note:** The grommets might be a different color than shown.



- 2 Make sure 4 Torx T6 (922-8655) mounting screws are installed on drive.

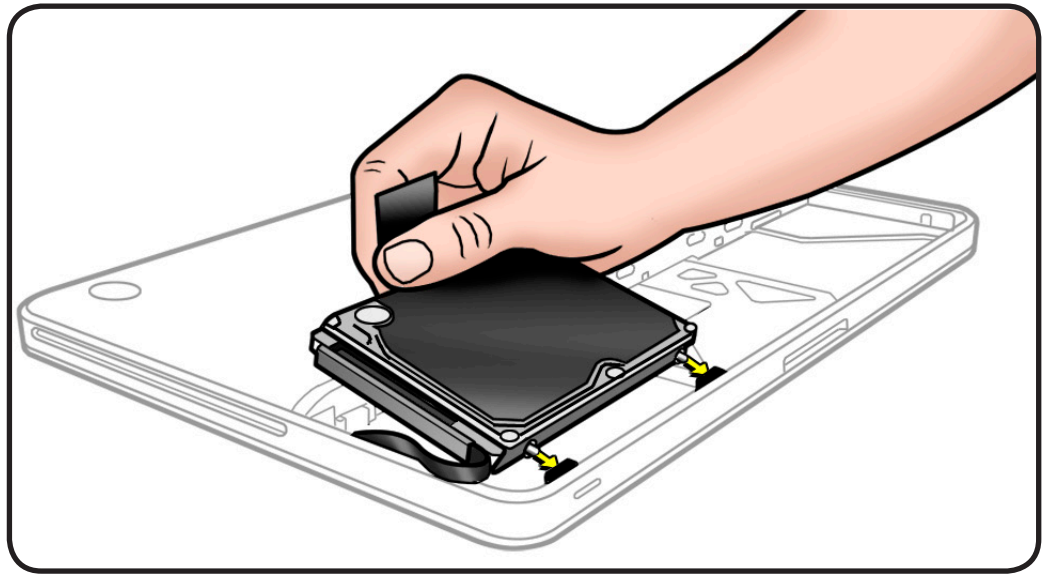
If replacement drive does not have mounting screws, transfer them from the old drive.







- 3 Attach connector, and tilt hard drive into front of top case.





## Reinstalling Software that Came with the Computer

Use the software install discs that came with your computer to install Mac OS X and the applications that came with your computer.

### Installing Mac OS X and Applications

To install Mac OS X and the applications that came with your computer, follow these steps:

1. Start up from the Mac OS X Install Disc 1 that came with your computer, and choose your language.
2. From the menu bar, choose Utilities > Disk Utility.
3. Open Disk Utility and select the new drive in the list to the left.

Note: If you are formatting the primary drive, use the Disk Utility program on the Install disc.

4. Click on the Partitions tab.
5. Select the startup drive, and name the volume "Macintosh HD."
6. At this point, either
  - Quit the Disk Utility application, and proceed with the Mac OS X installation following the onscreen instructions. Your computer may restart and ask you to insert the next Mac OS X Install Disc 2. or
  - Click the "+" or "-" signs to resize or partition the selected disk, following onscreen instructions, then click Apply.

### Installing Applications

To install just the applications that came with the computer, follow the steps below. The computer must have Mac OS X already installed.

1. Back up your essential files, if possible.
2. Insert the Mac OS X Install Disc 1 that came with your computer.
3. Double-click "Install Bundled Software Only."
4. Follow the onscreen instructions.
5. After selecting the destination disk for installation, continue following onscreen instructions. After restart, insert the next Mac OS X Install Disc 2.
6. Restore the data by reinstalling the backed up files from your backup to the new drive.

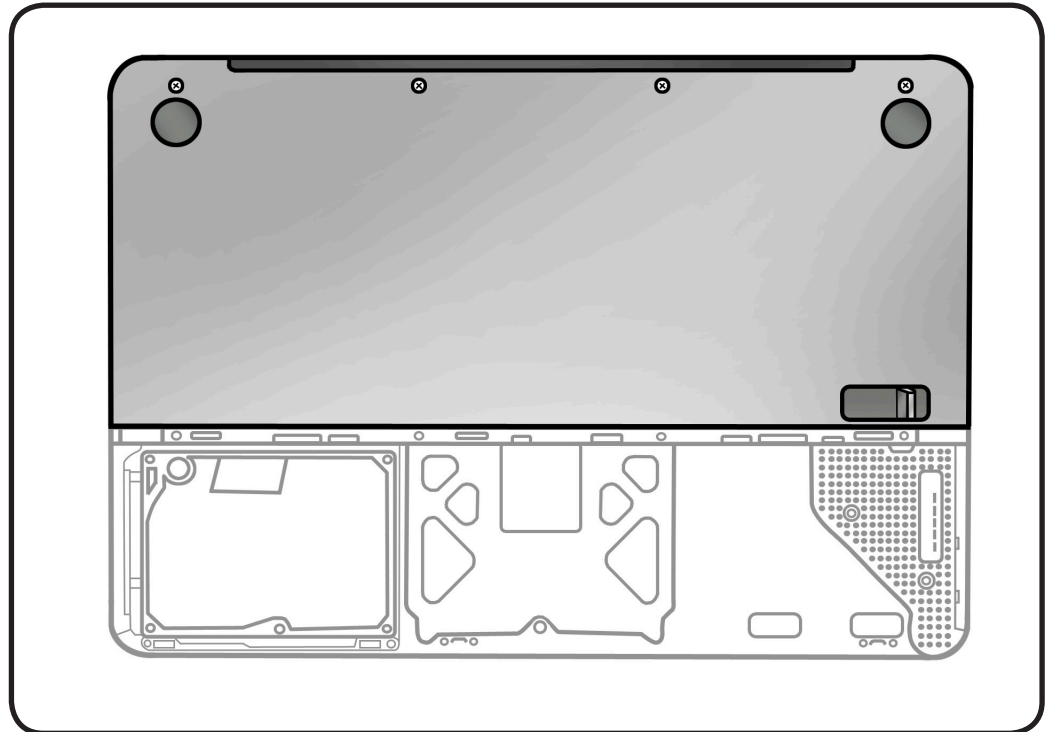


# Bottom Case

## First Steps

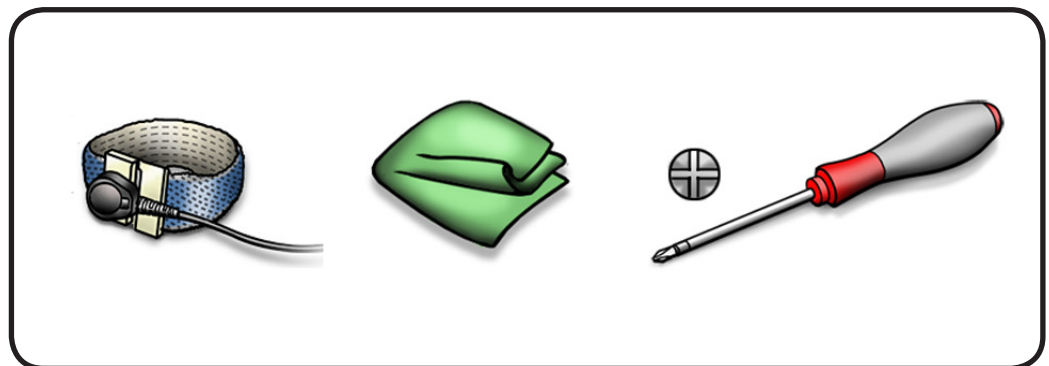
Remove:

- [Access door](#)
- [Battery](#)



## Tools

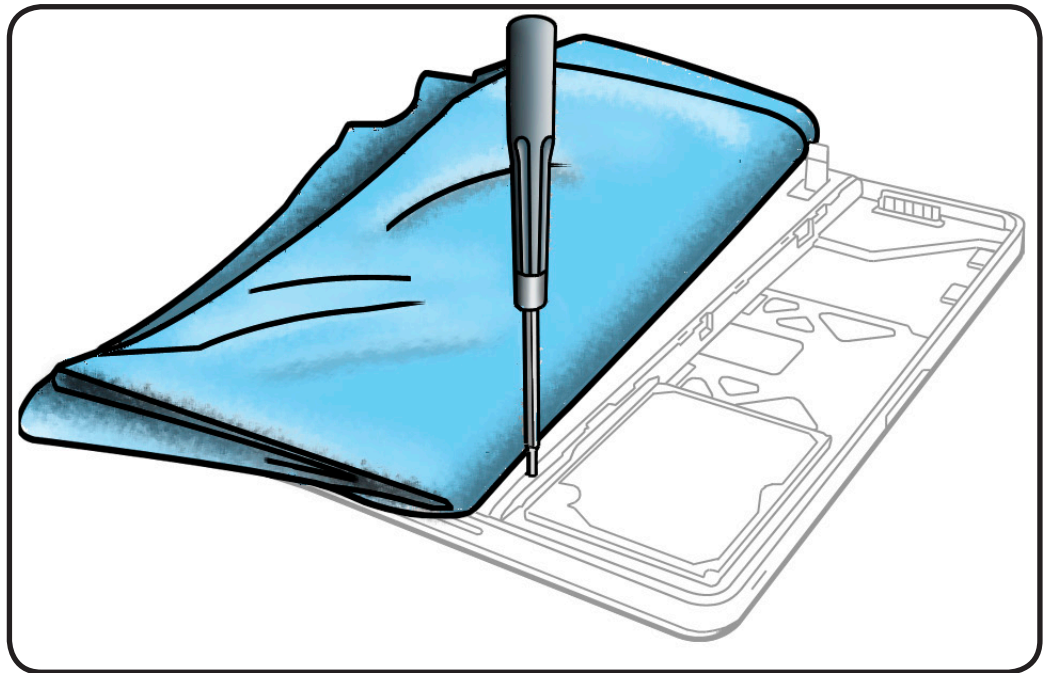
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetic Phillips #00 screwdriver





## Removal

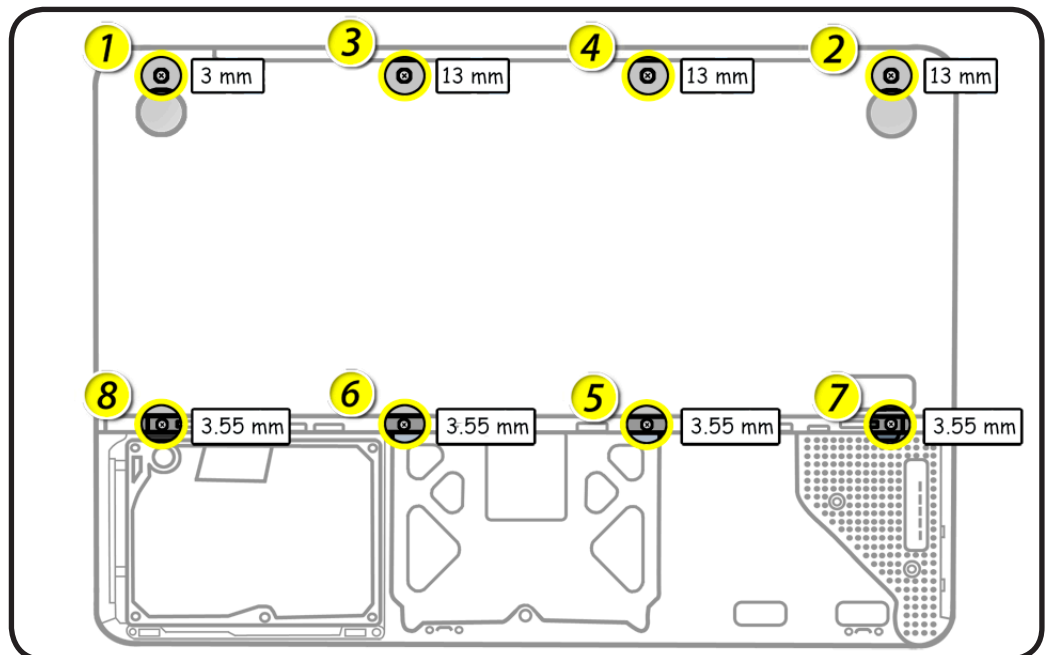
**Caution:** To prevent scratches, use a protective cloth when working with metal tools.



### 1 Remove 8 screws:

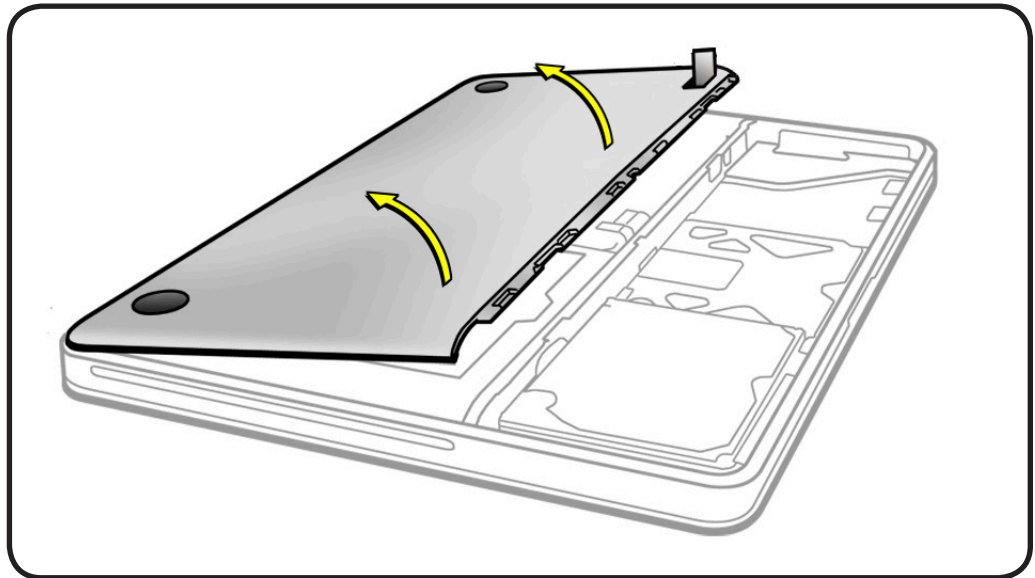
- 1 (3 mm) 922-8660
- 3 (13 mm) 922-8666
- 4 (3.55 mm) 922-8653

**Replacement Note:** Install screws in the order shown.



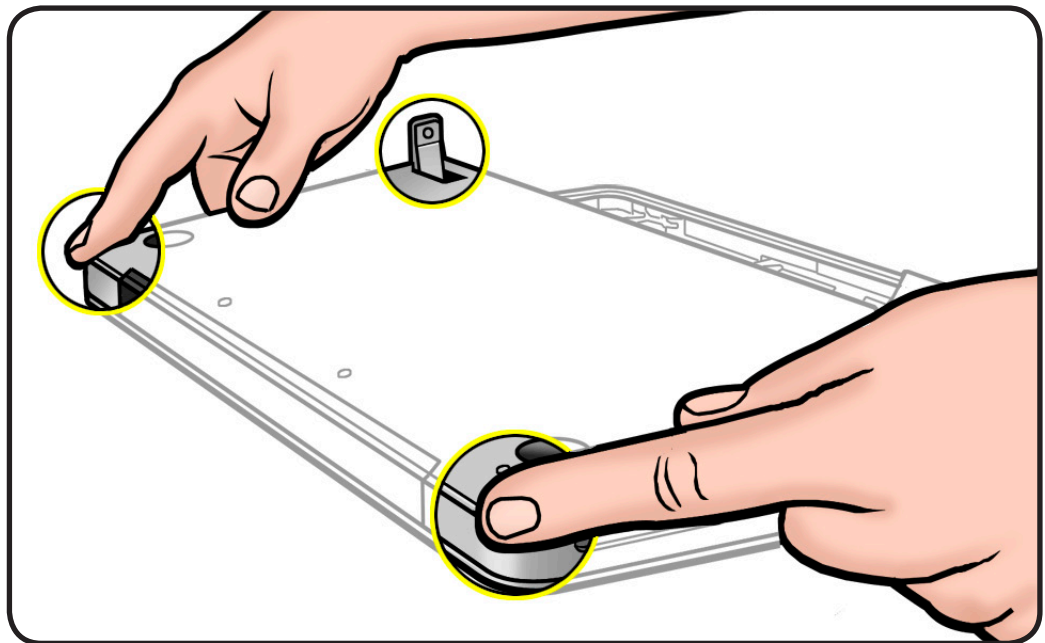


- 2 Grasp lever and tilt up bottom case.



## Replacement

- 1 Press corners to align bottom case to top case.
- 2 Check alignment as you install screws.





# Memory

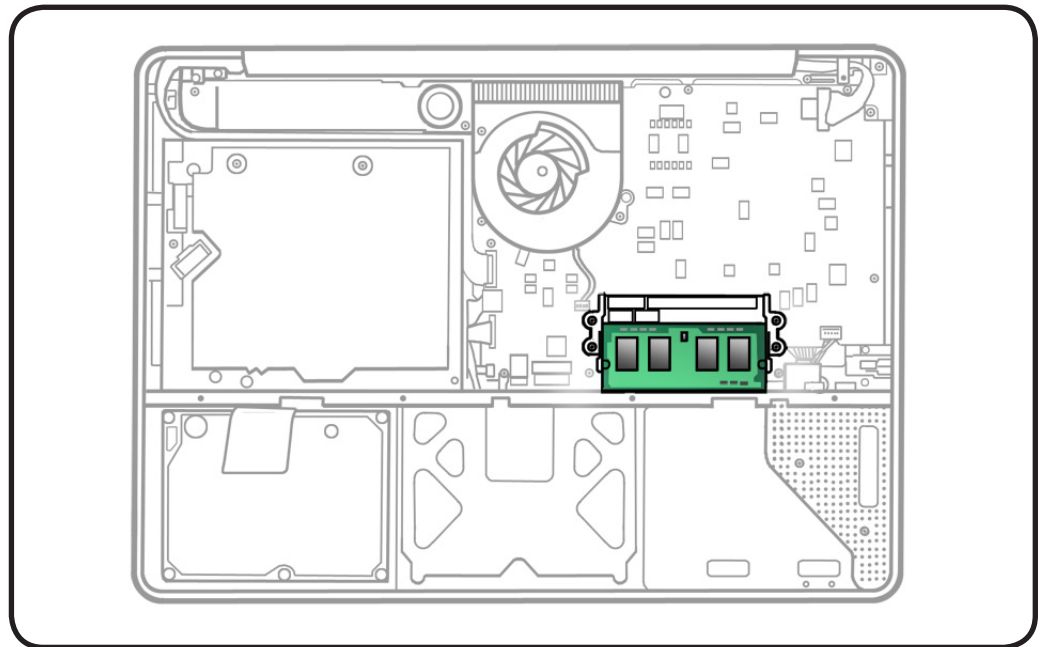
## First Steps

Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)

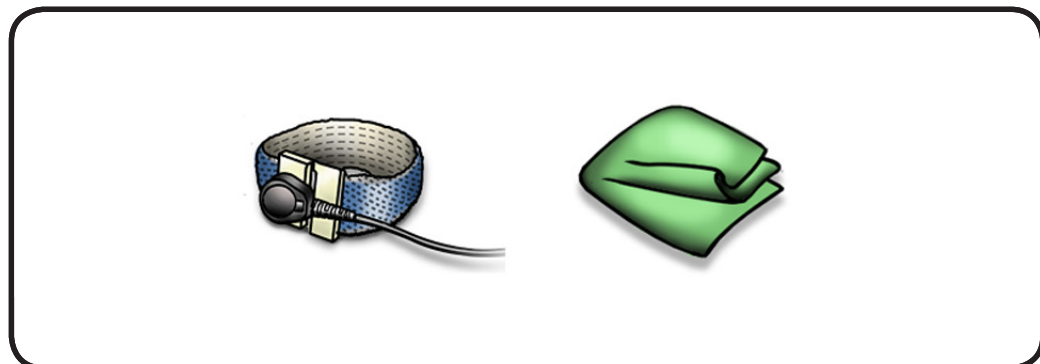


**Caution:** Avoid touching anything other than the memory area.



## Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat





## Removal

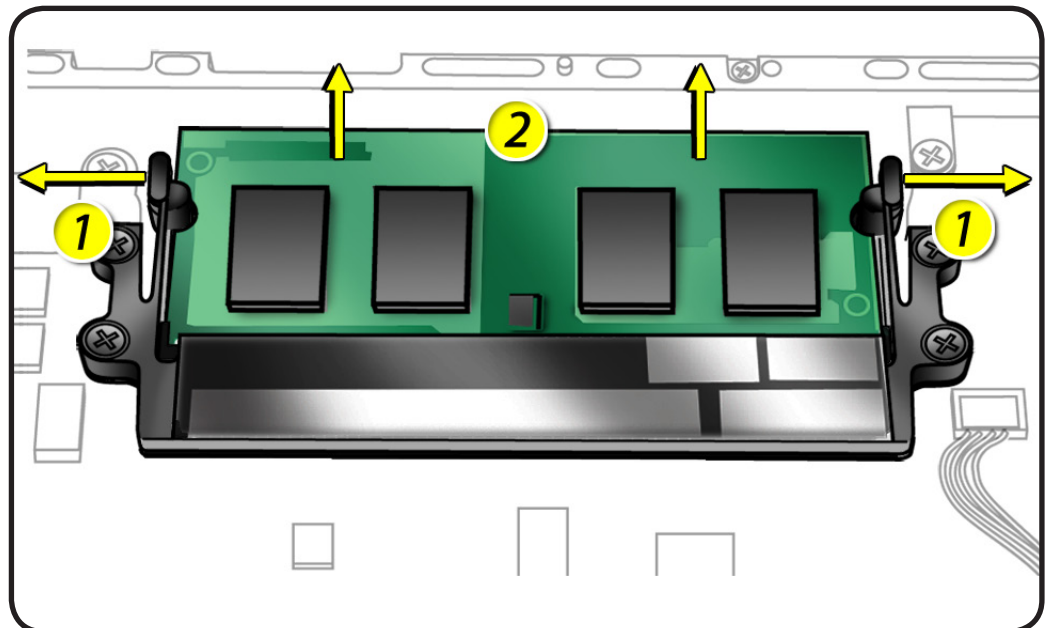
Memory cards must be:

- 1.25 inch or smaller
- 1 GB or 2 GB
- 204-pin
- PC-8500 DDR3, 1066 MHz RAM

This computer comes with a minimum of 2 GB of 1066 MHz Double Data Rate 3 (DDR3) Synchronous Dynamic Random-Access Memory (SDRAM) installed. It has two slots that can accept SDRAM Small Outline Dual Inline Memory Modules (SO-DIMMs). The slots are stacked on the logic board under the bottom case. For best performance, memory should be installed as pairs with an equal memory card in each slot. The maximum amount of memory for this computer is 4 GB, with a 2 GB DIMM installed in each slot.

- 1 Press out 2 ejection levers until the card pops up completely,

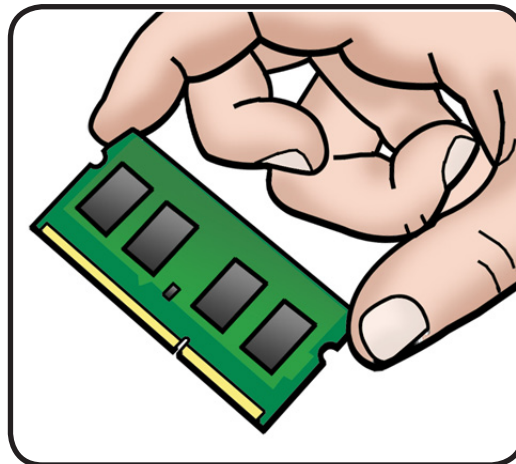
The card pops up at an angle. Before removing the card, make sure you see the half-circle notches. If not, press the ejection levers again.



- 2 Pull out the card.

- 3 Hold the card by the edges.

- 4 Do not touch the gold connectors.

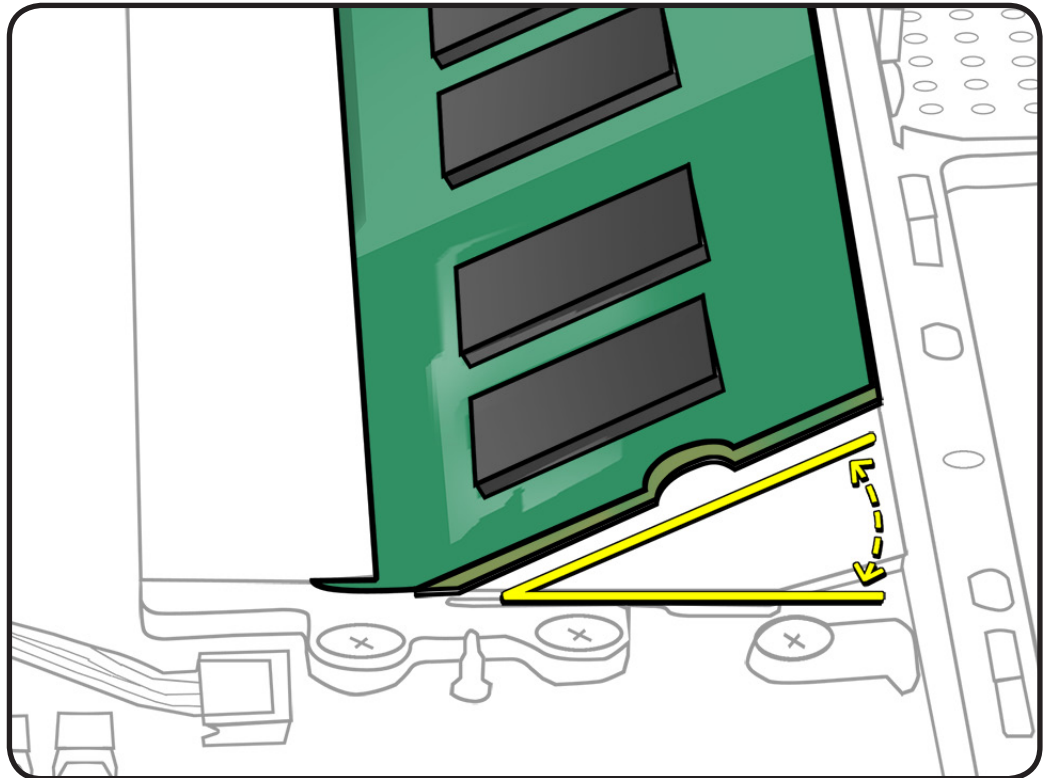






## Replacement

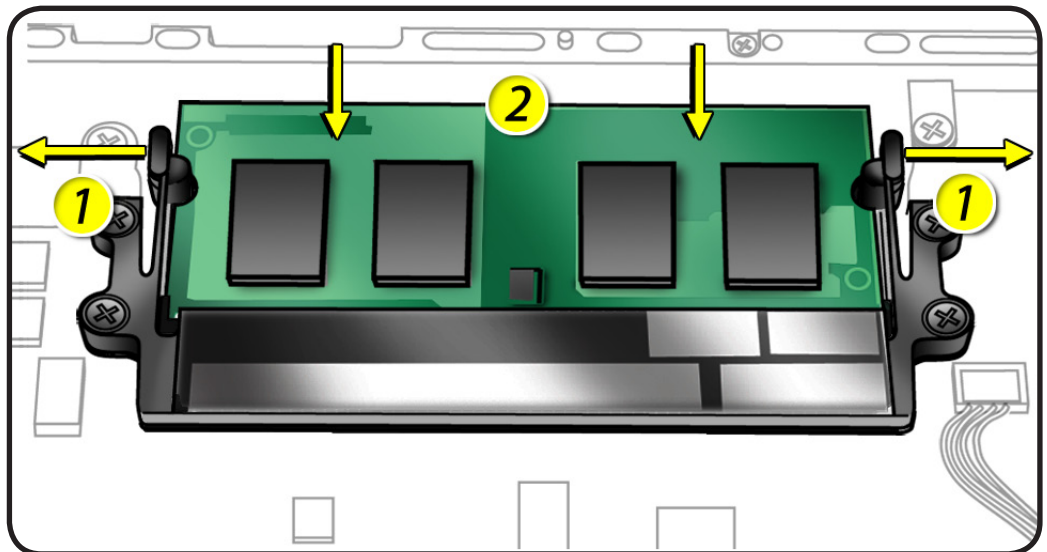
- 1 Install cards at an angle. If installing just one card, install it in lower slot.



- 2 Spread ejection levers, and press card down.

**Note:** New memory cards might have a harmless white residue on the gold connectors.

- 3 If you installed additional memory, check that computer recognizes it.





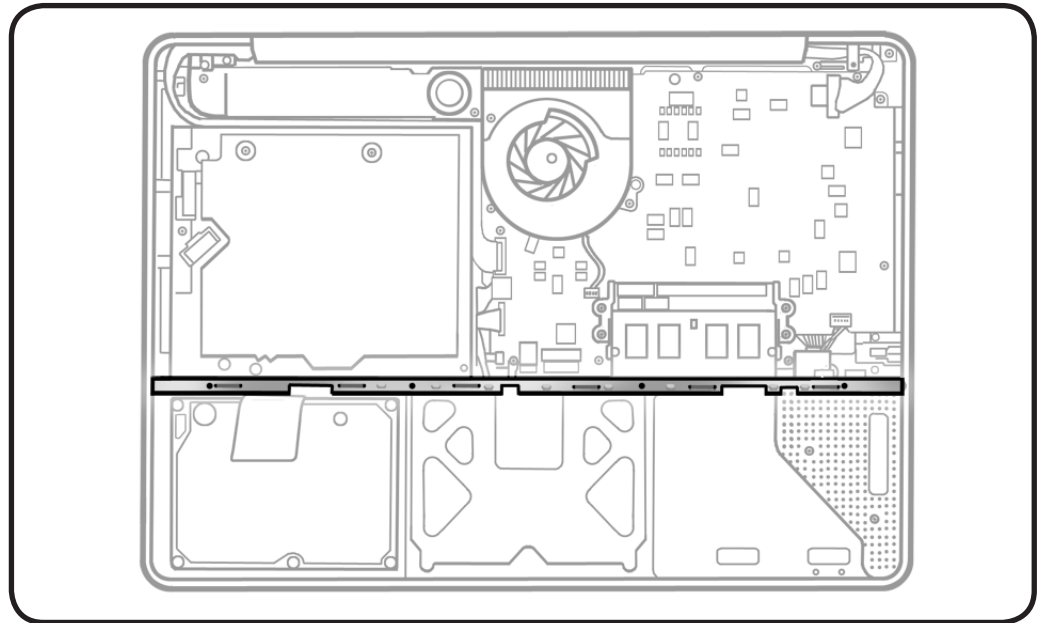


# Mid Wall

## First Steps

Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)

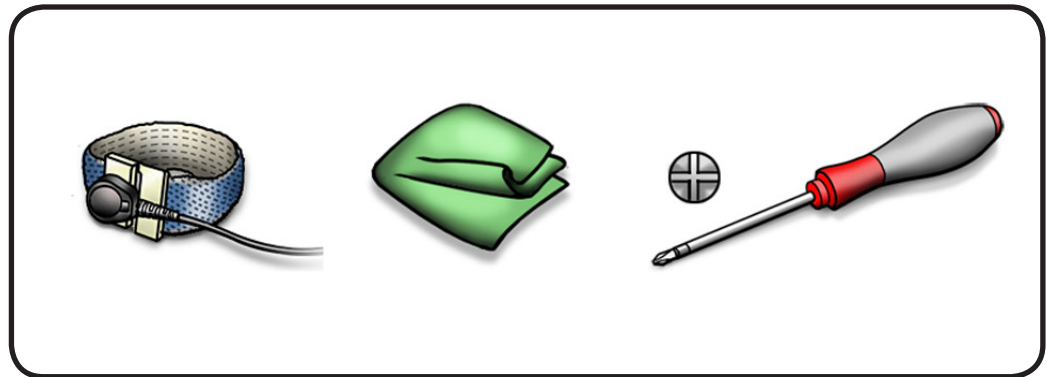


## Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver



**Caution:** The screws for this procedure require a newer screwdriver. Using a dull screwdriver can damage the screw heads.





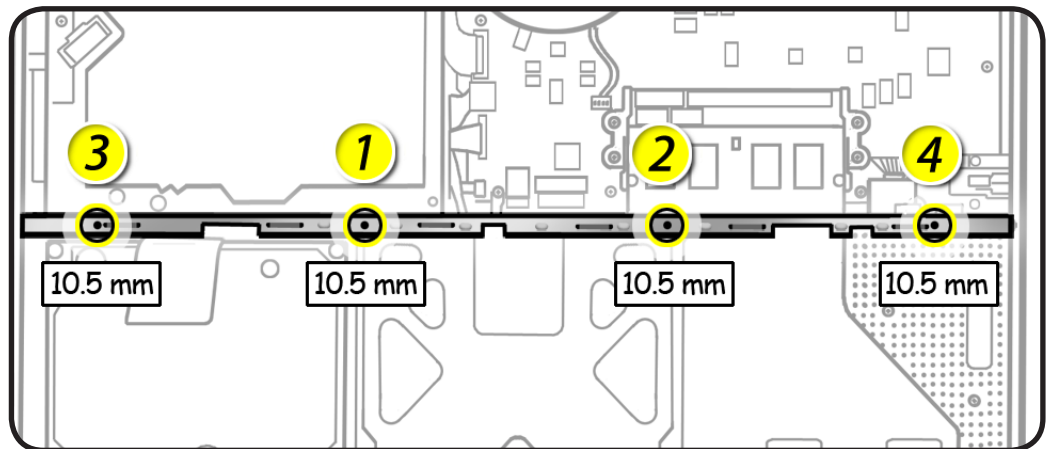
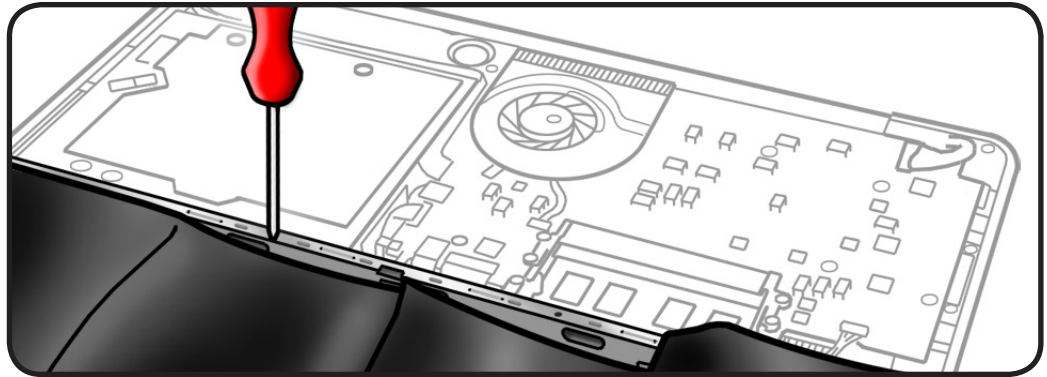
## Removal



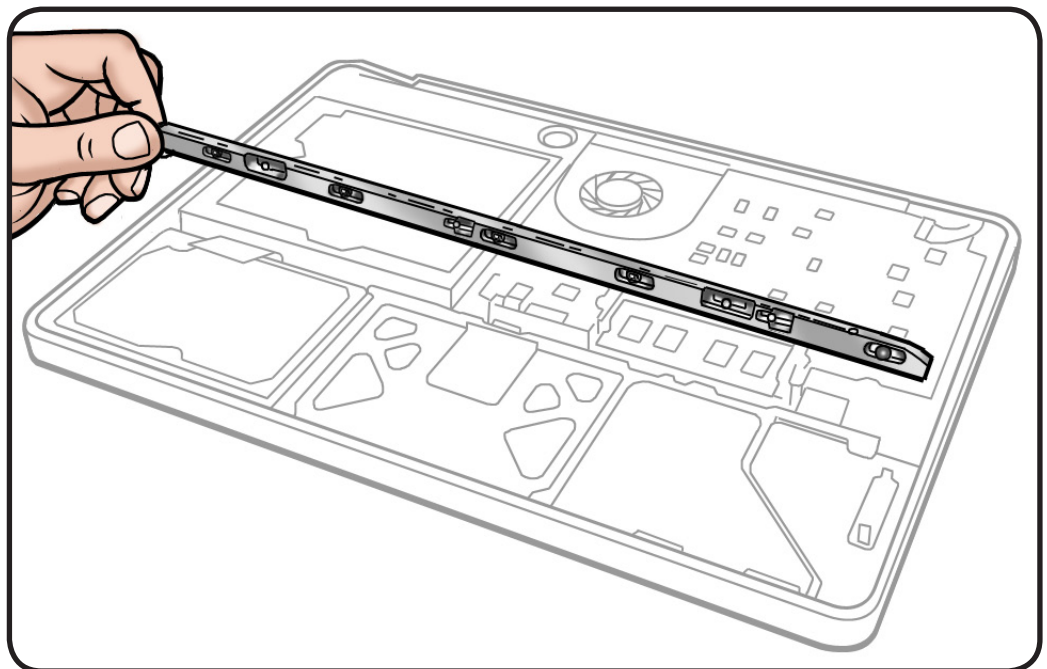
To prevent scratches to the computer housing, use a soft cloth when removing and installing screws.

- 1 Remove 4 (10.5-mm) 922-8656 screws in order shown.

**Replacement Note:** Install screws in order shown.



- 2 Lift out mid wall.





# Battery Connector Cover

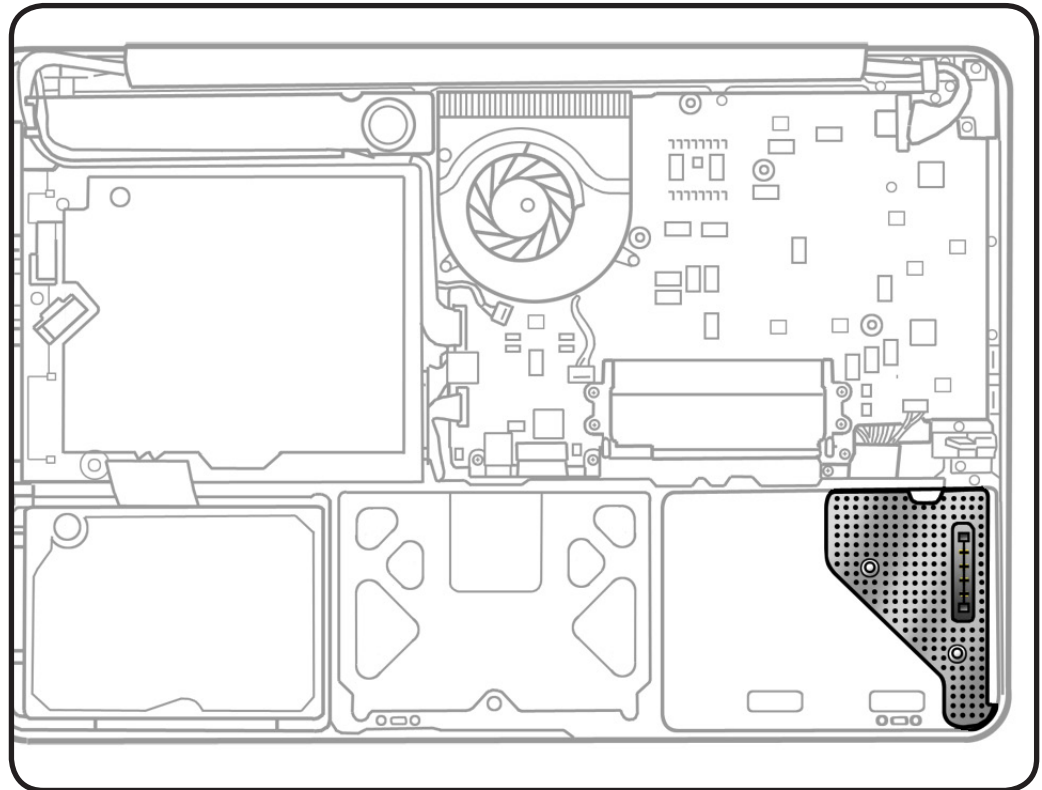
## First Steps

Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Mid wall](#)

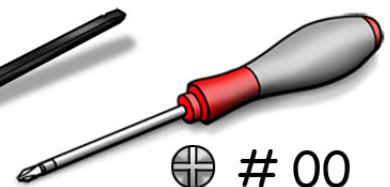


To prevent scratches to the computer housing, use a soft cloth when removing and installing screws.



## Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
- Black stick



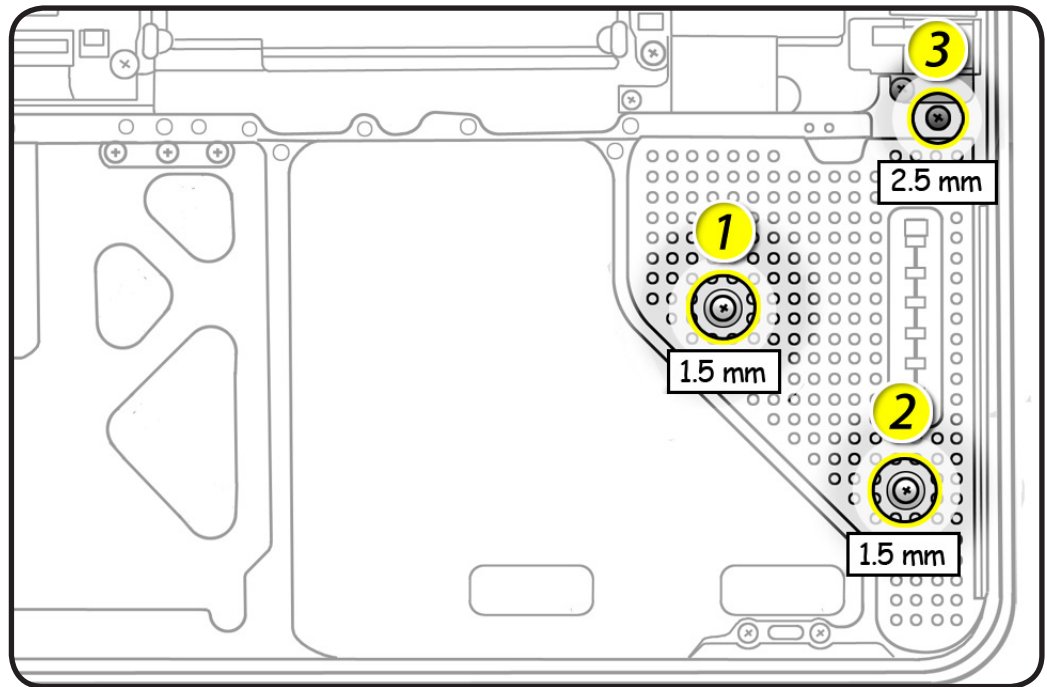
⊕ # 00



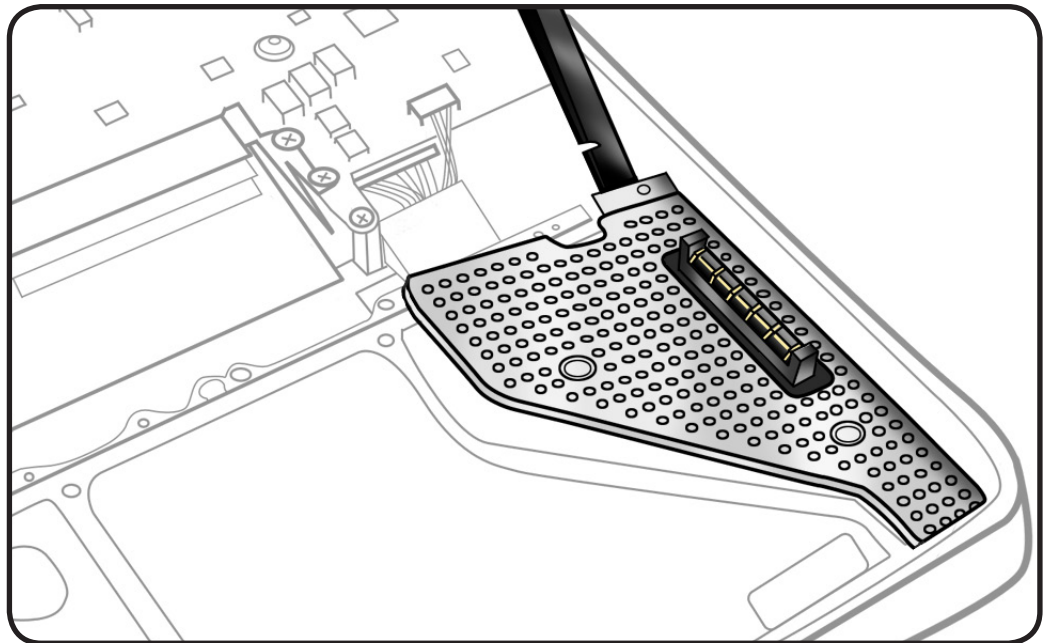
## Removal

- 1** Remove 3 screws:
  - 1 (2.5 mm) 922-8652
  - 2 (1.5 mm) 922-8651

**Replacement Note:**  
Install screws in order shown.



- 2** Lift out battery connector cover.





# Battery Cable Guide

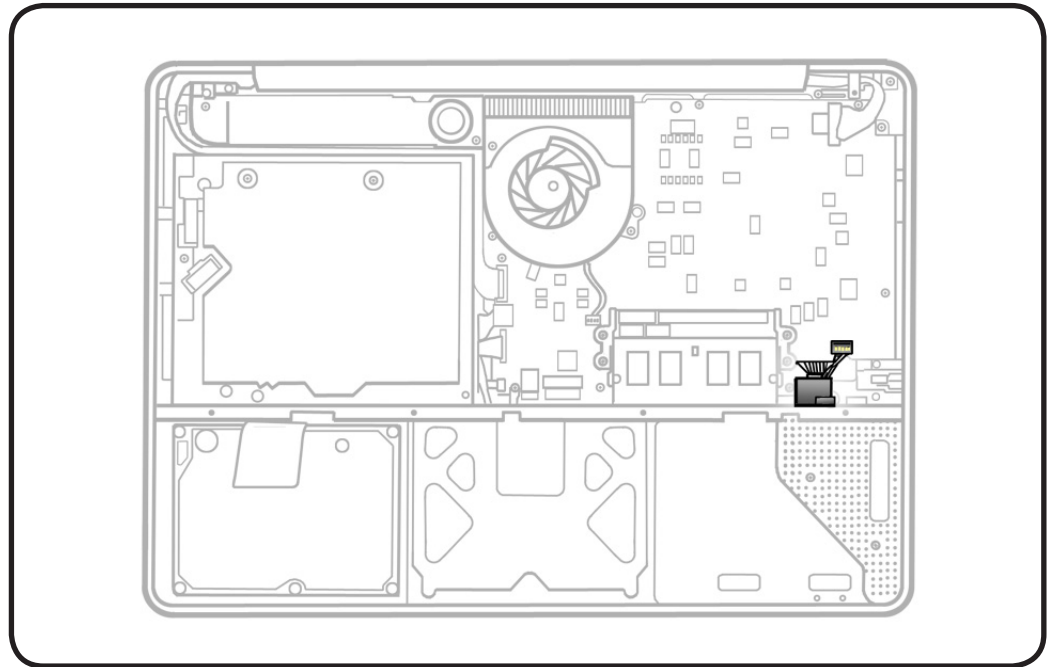
## First Steps

Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Mid wall](#)
- [Battery connector cover](#)

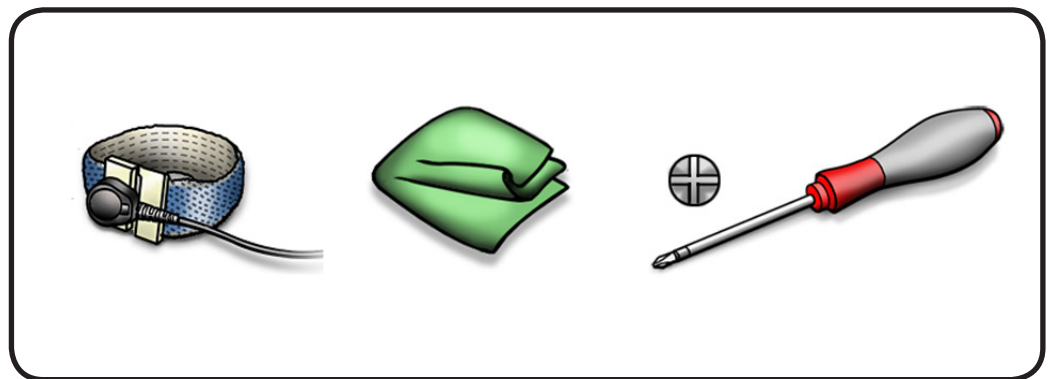


To prevent scratches to the computer housing, use a soft cloth when removing and installing screws.



## Tools

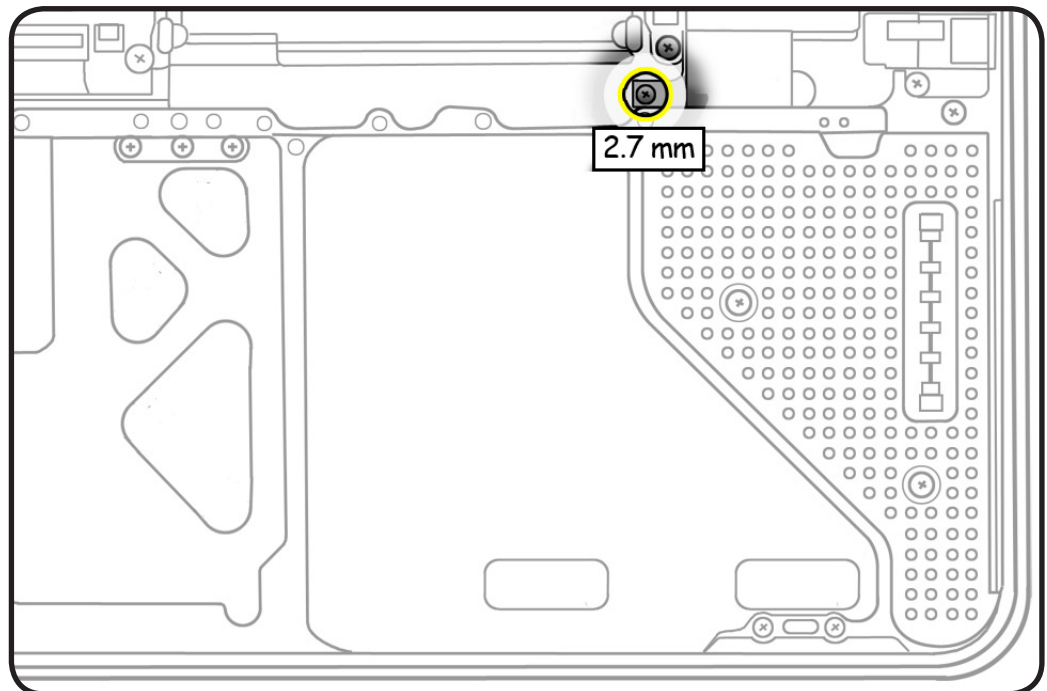
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver



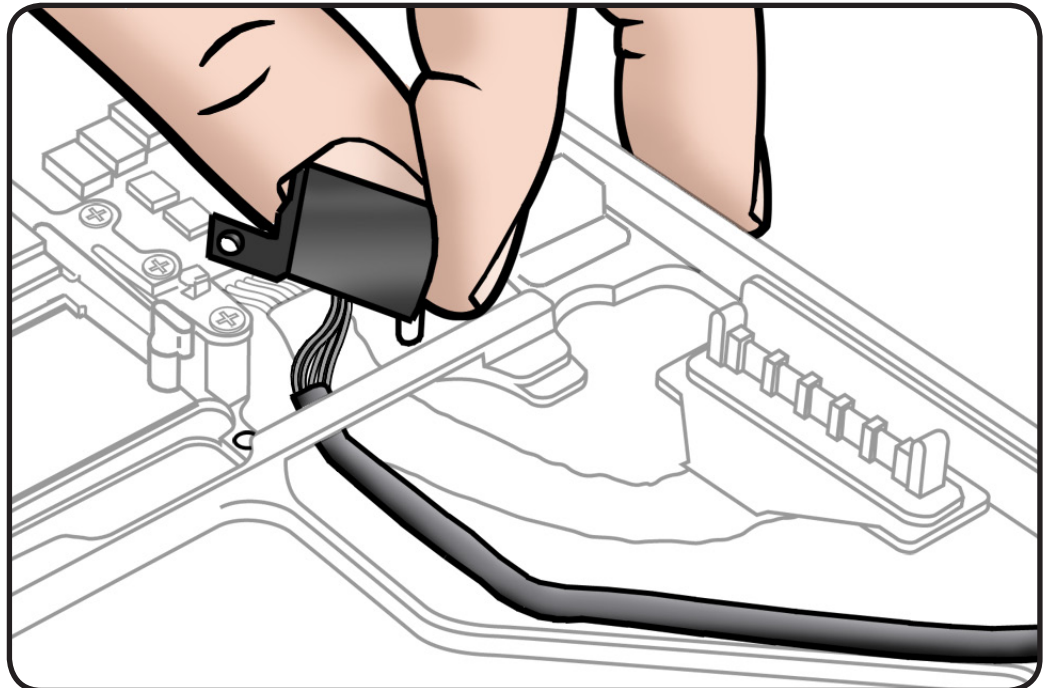


## Removal

- 1 Remove 2.7-mm (922-8661) screw.



- 2 Lift out battery cable guide.





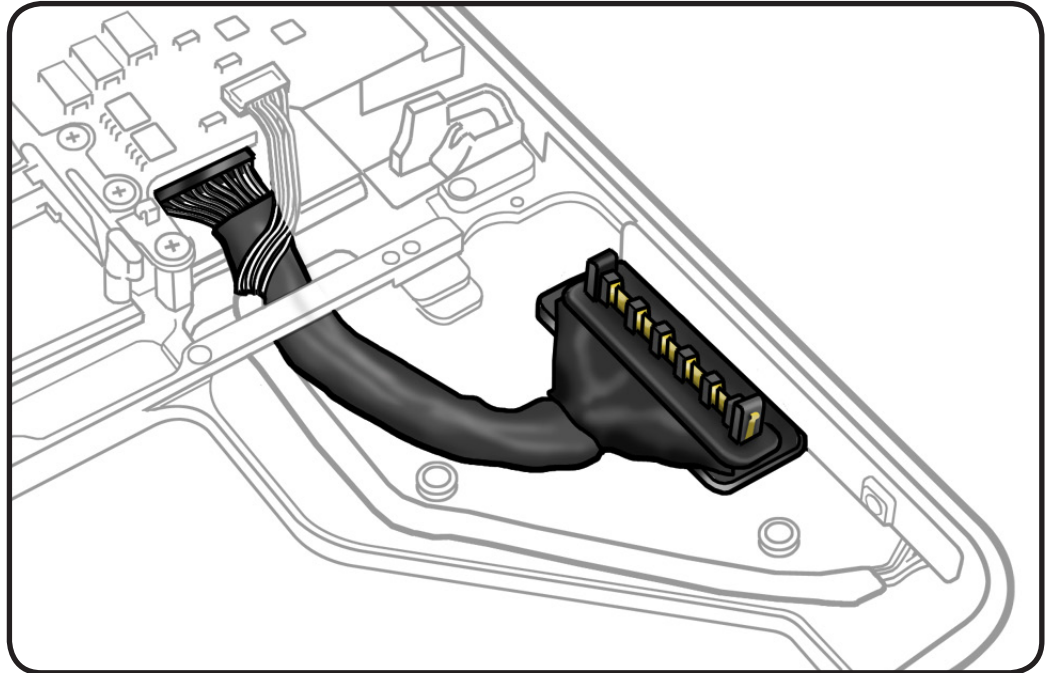


# Battery Power Cable

## First Steps

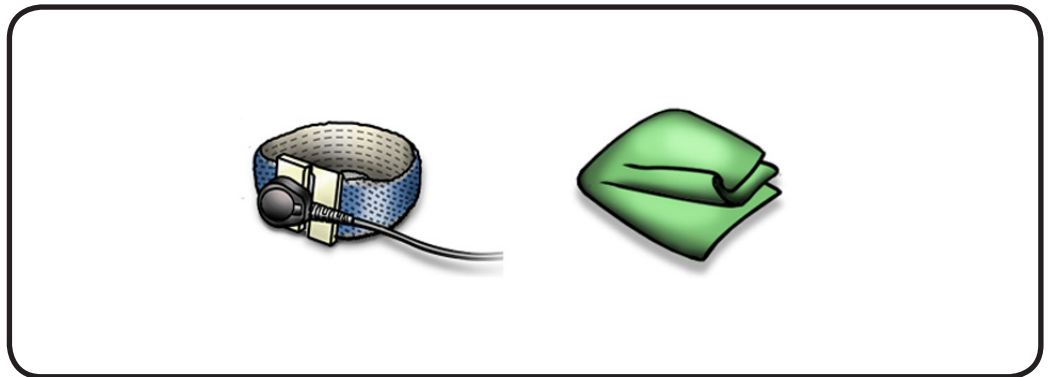
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Mid wall](#)
- [Battery connector cover](#)
- [Battery cable guide](#)



## Tools

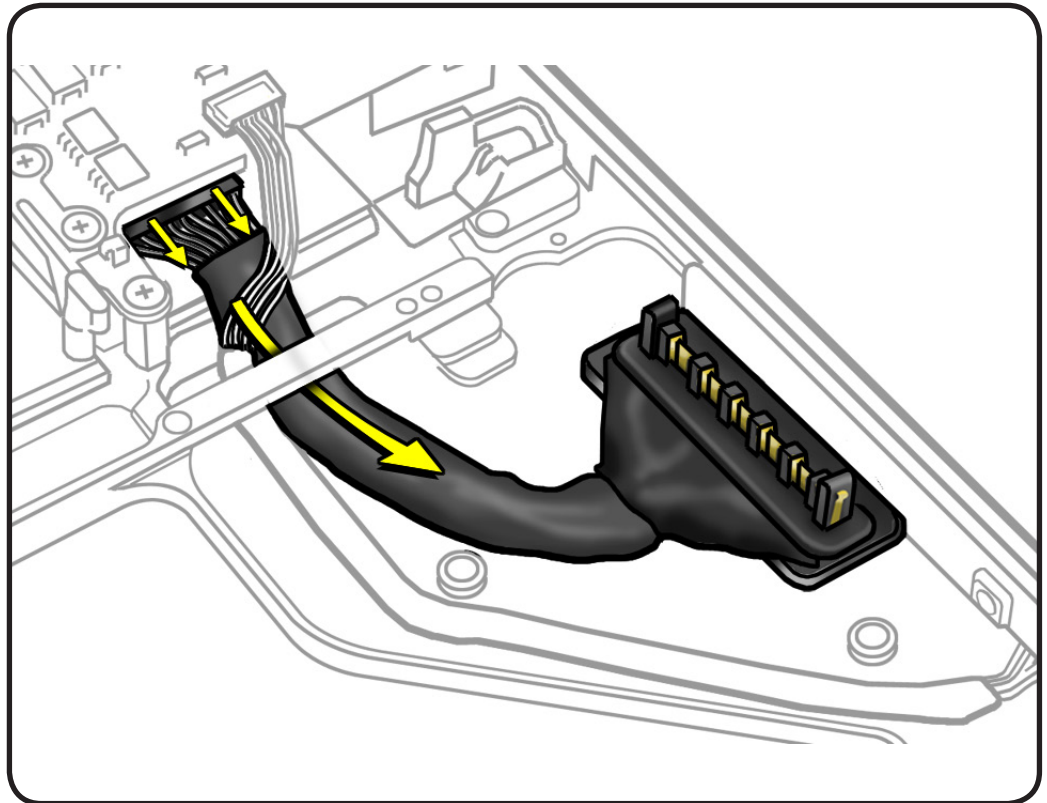
- Clean, soft, lint-free cloth
- ESD wrist strap and mat





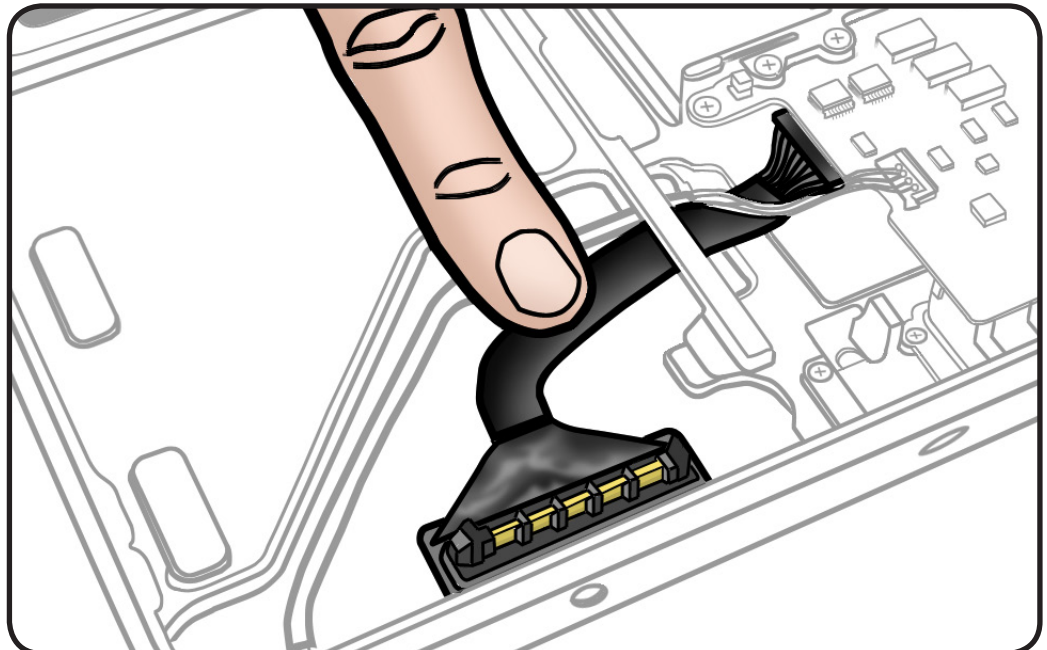
## Removal

- 1 Disconnect the battery cable, and peel it up from the top case.
- 2 Route the cable through the top case slot.



## Replacement

- 1 Connect cable to logic board.
- 2 Press cable to top case so it lays flat.





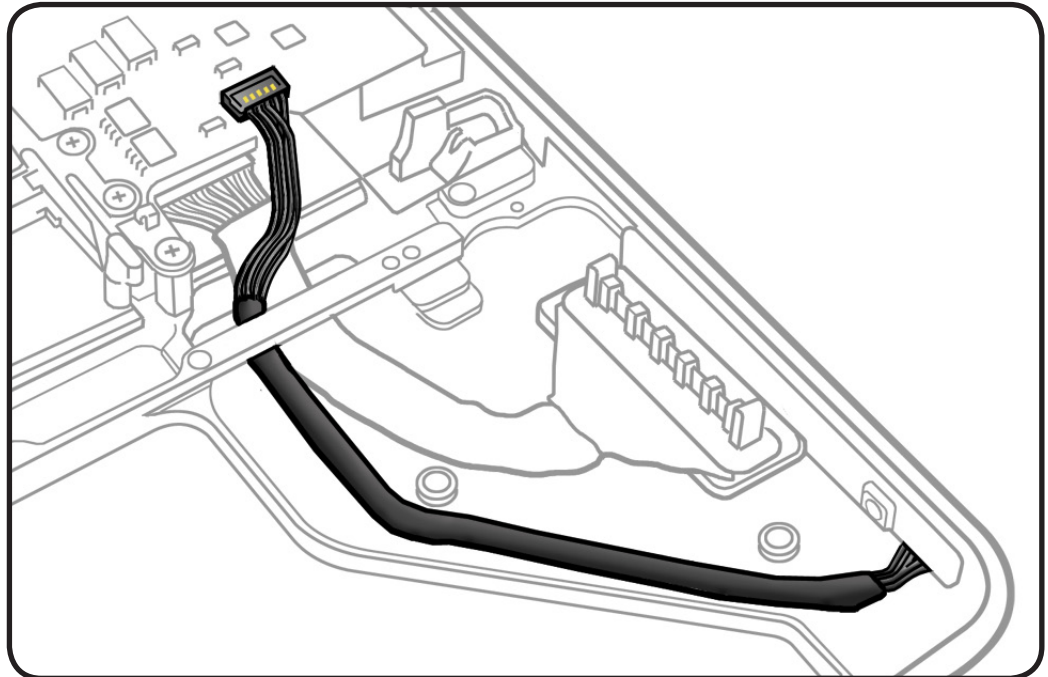


# Battery Indicator Light (BIL) Cable

## First Steps

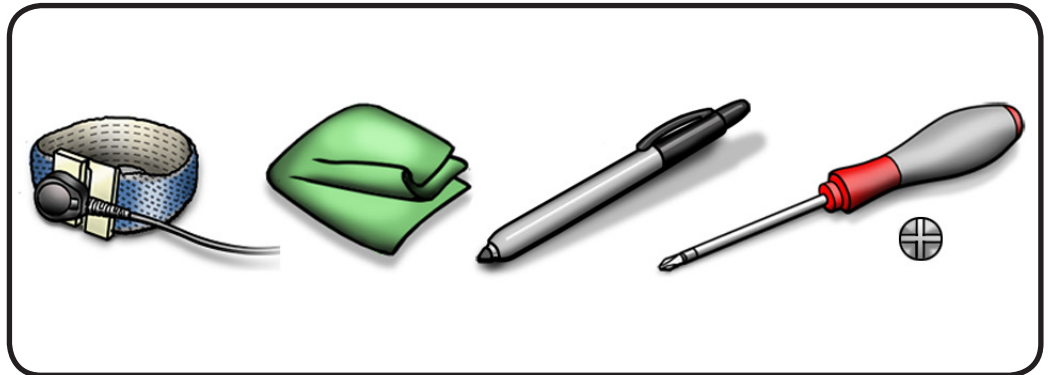
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Mid wall](#)
- [Battery connector cover](#)



## Tools

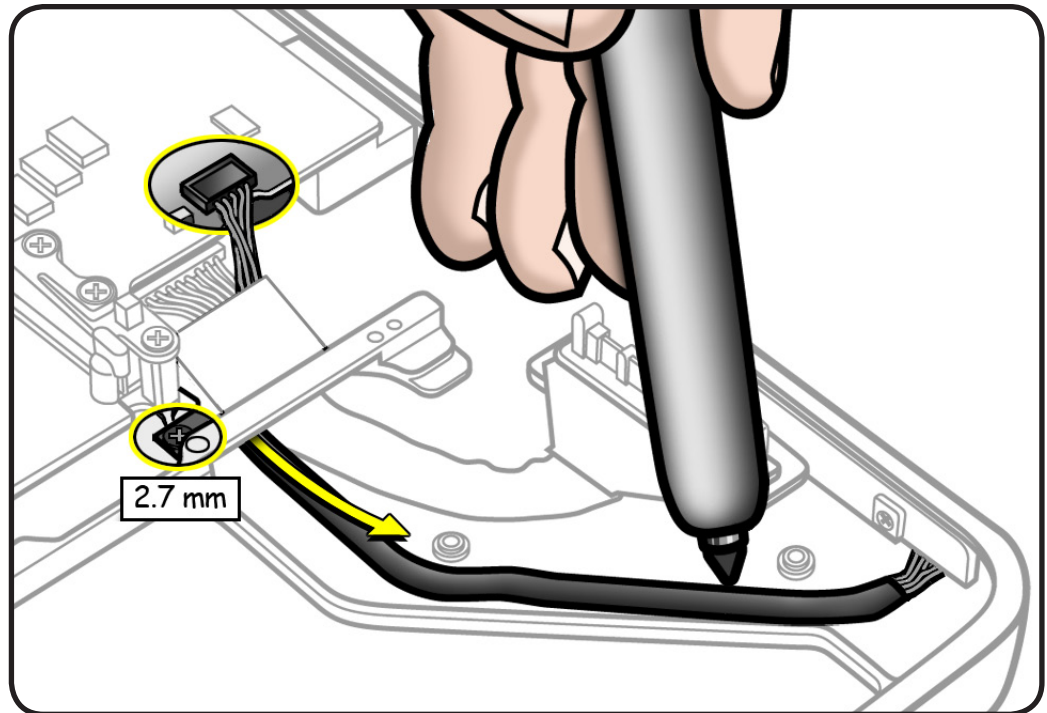
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
- Permanent marking felt-tip pen



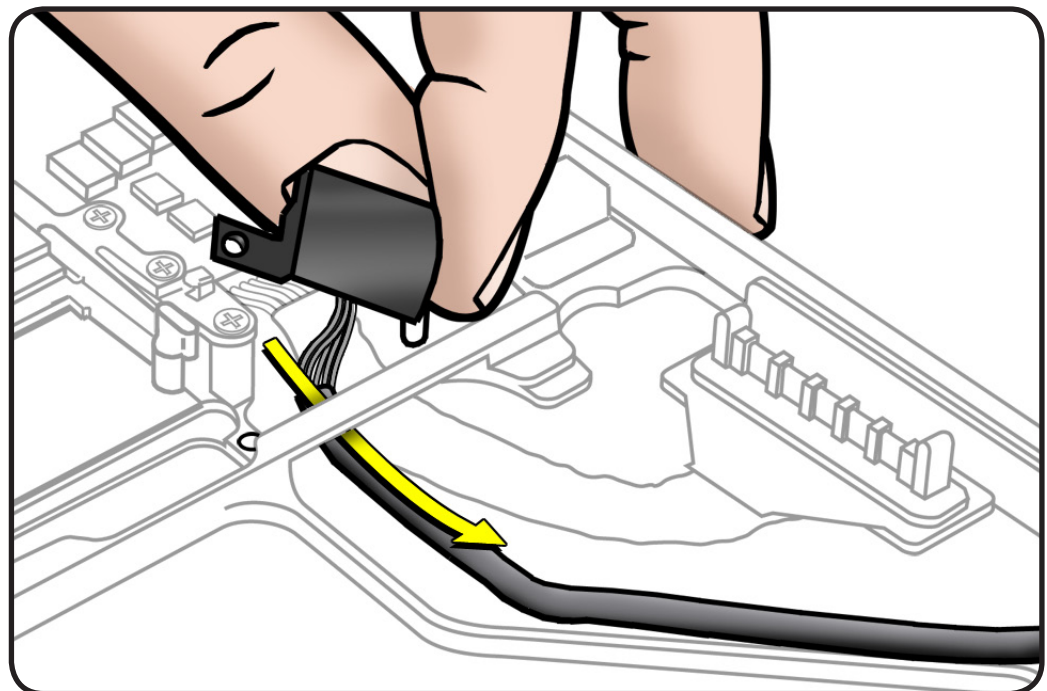


## Removal

- 1 Draw line on inner edge of cable, to mark cable routing.
- 2 Remove 2.7 mm (922-8661) screw.
- 3 Disconnect cable from logic board.

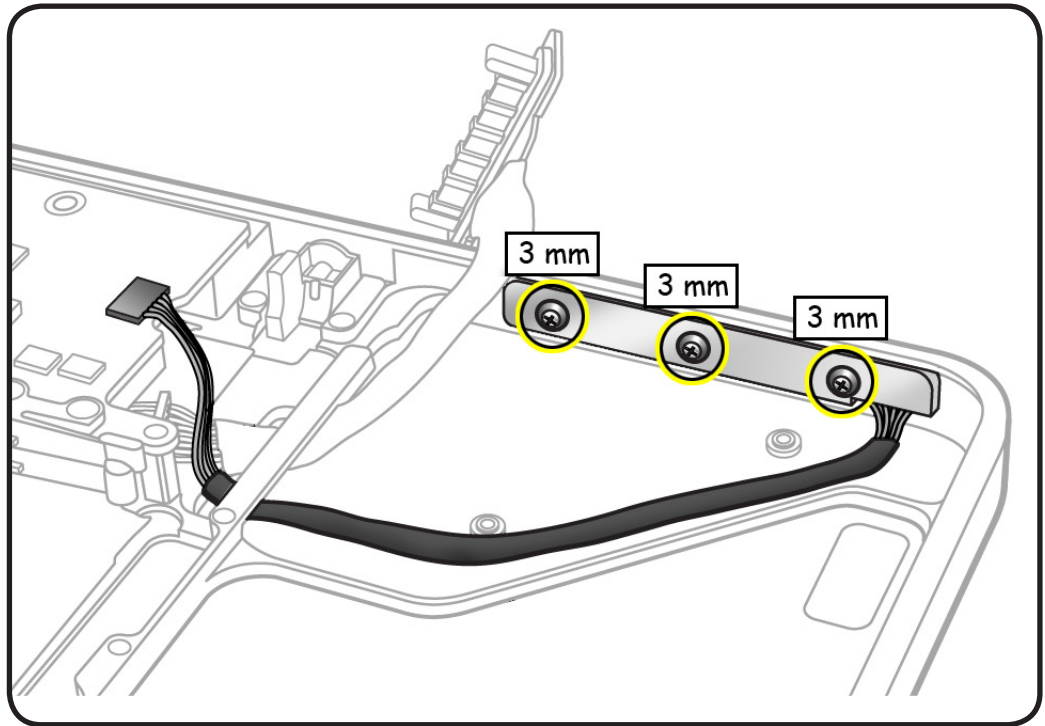


- 4 Remove [battery cable guide](#).
- 5 Route cable through top case wall.



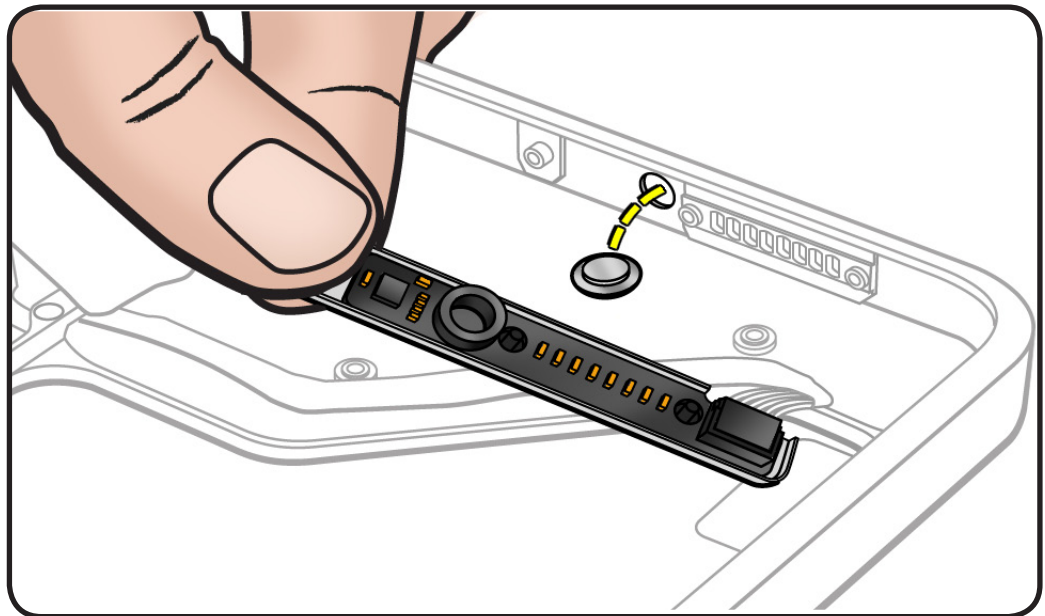


- 6 Remove 3 (3-mm) 922-8657 screws.
- 7 Lift up BIL board from side of top case.



- 8 Disconnect cable from BIL board.

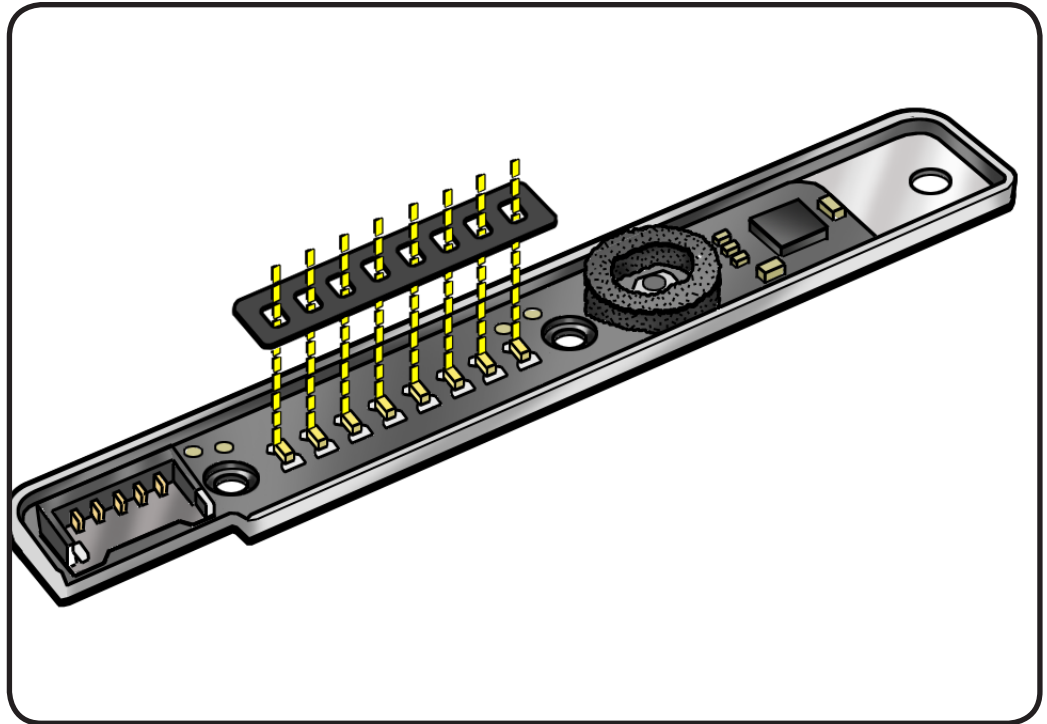
**Note:** With board removed, BIL button might pop out. Make sure you retain the BIL button.



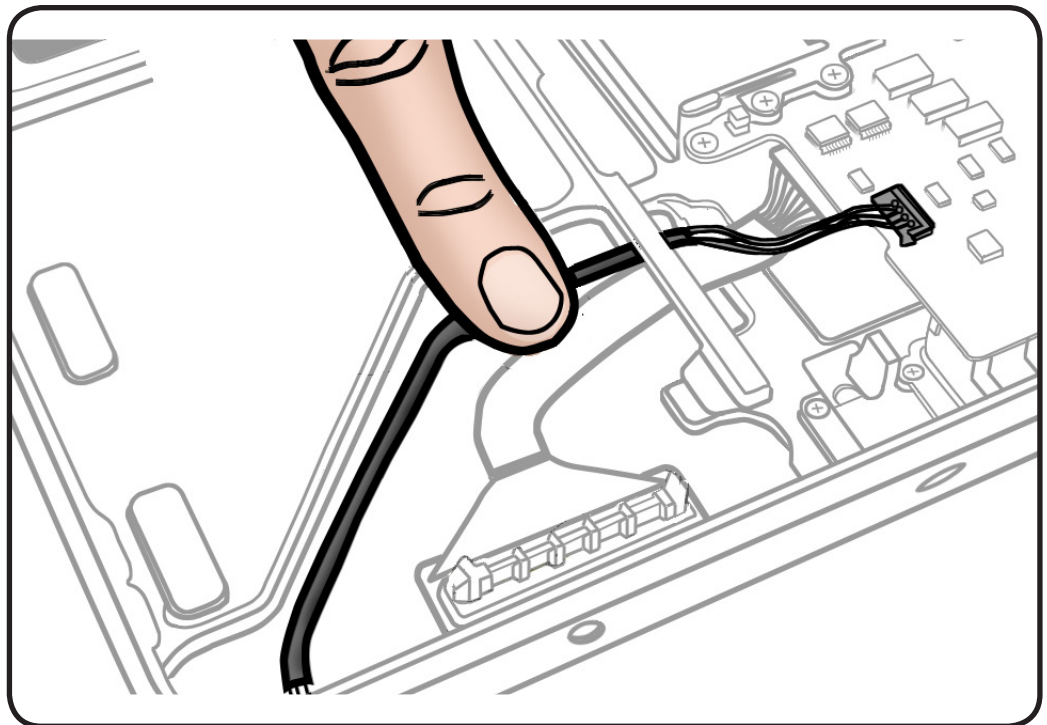


## Replacement

- 1 Make sure rubber gasket is installed on inner side of BIL board.
- 2 Set and hold button in top case wall. Then install cable and BIL board.



- 3 Press cable so it lays completely flat.



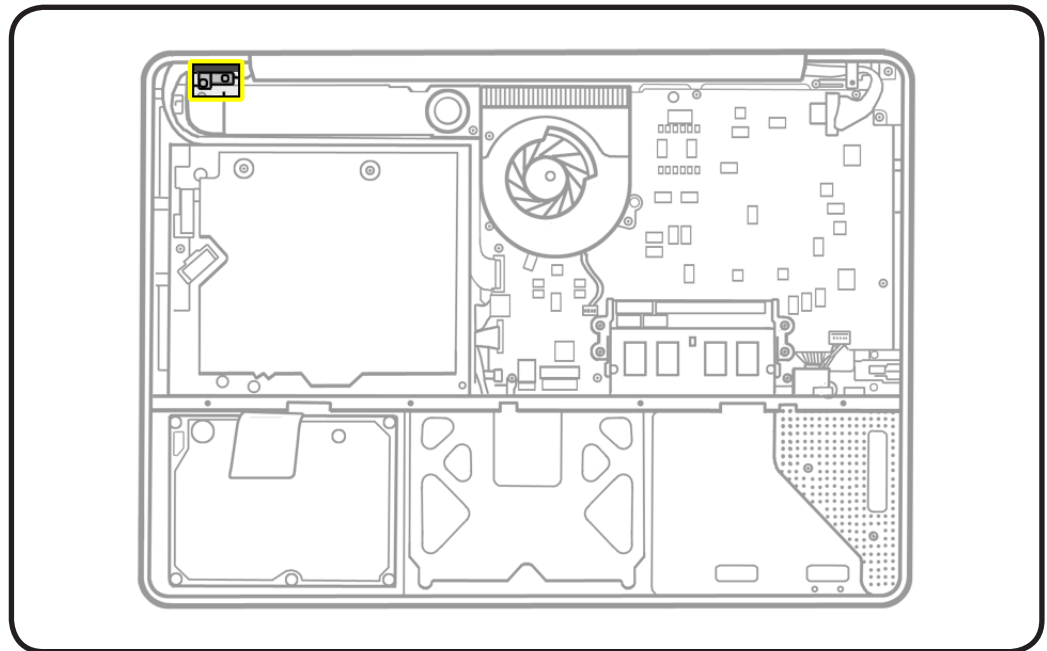


# Camera Cable Guide

## First Steps

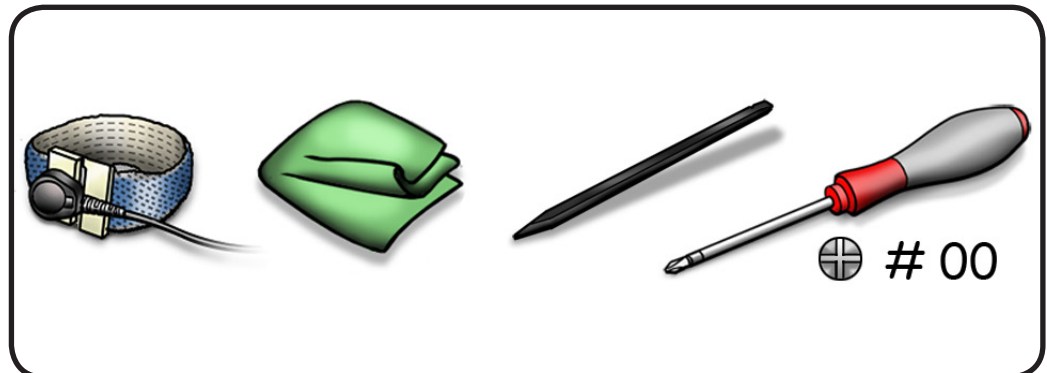
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)



## Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
- Black stick



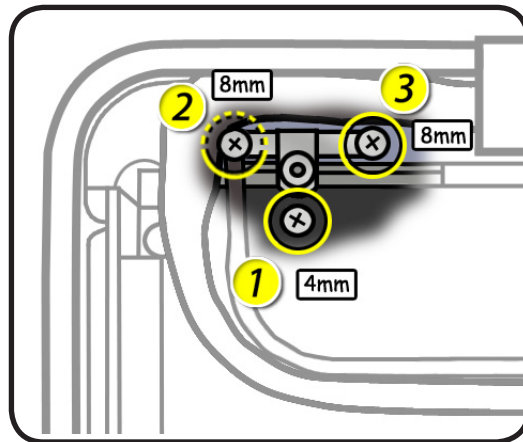




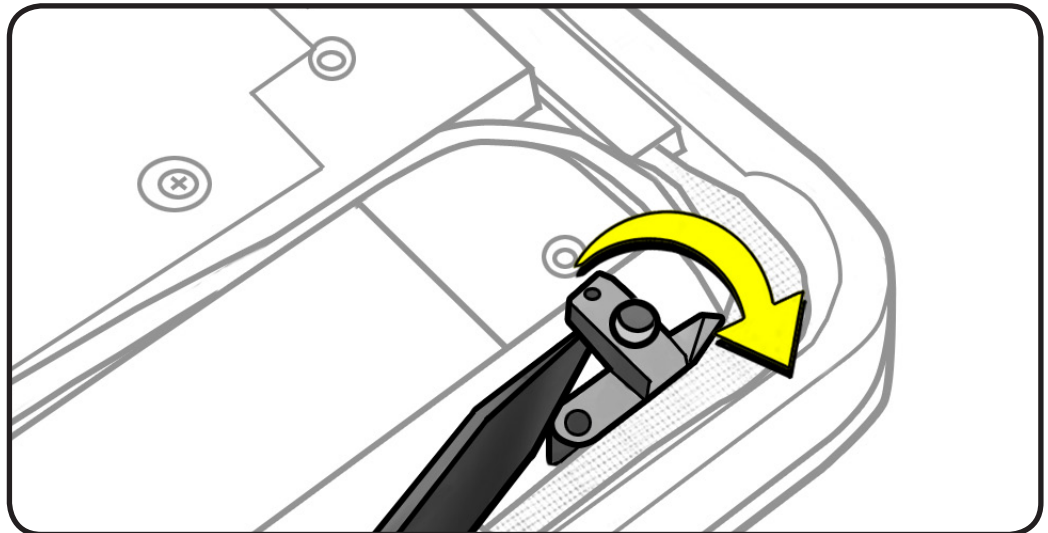
## Removal

- 1 Remove 3 screws:
  - 1 (4-mm) 922-8650
  - 2 (8-mm) 922-8665

**Replacement Note:**  
Install screws in order shown.

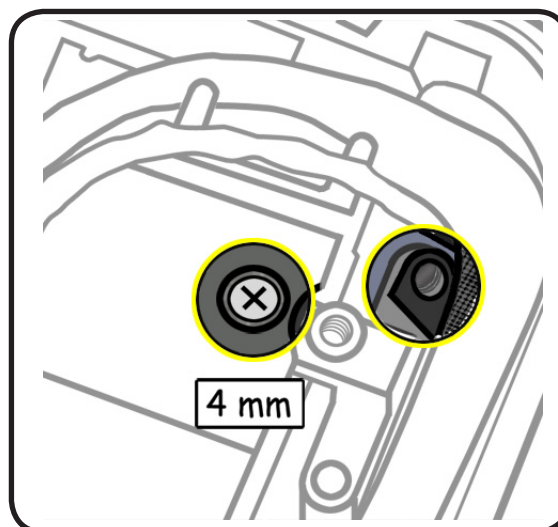


- 2 Use a black stick to tilt out the camera cable guide.



## Replacement

- 1 **Important:** Insert the cable guide under the speaker and install the 4-mm screw (922-8650).
- 2 Make sure the ground tab is over the cable guide before installing the 2 remaining screws.



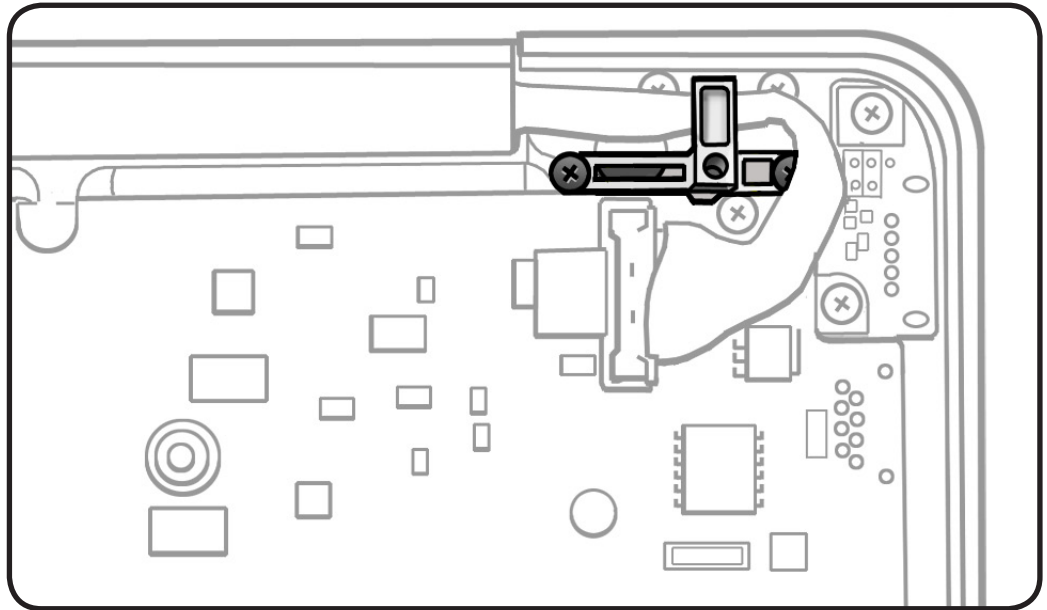


# LVDS Cable Guide

## First Steps

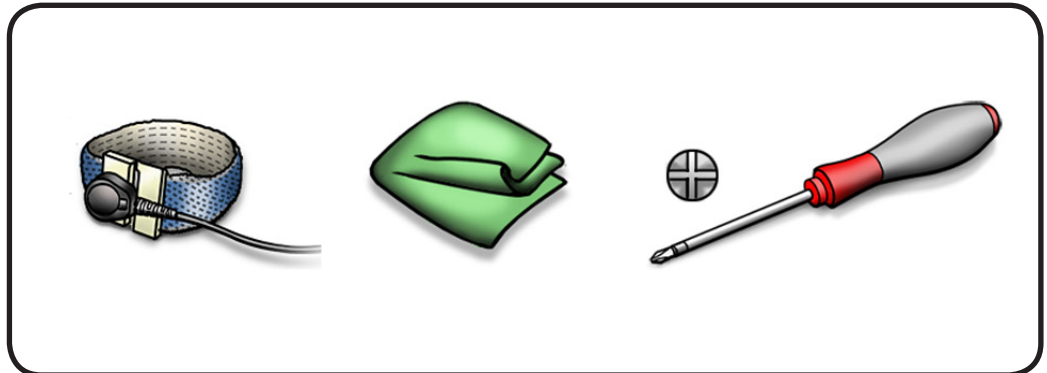
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)



## Tools

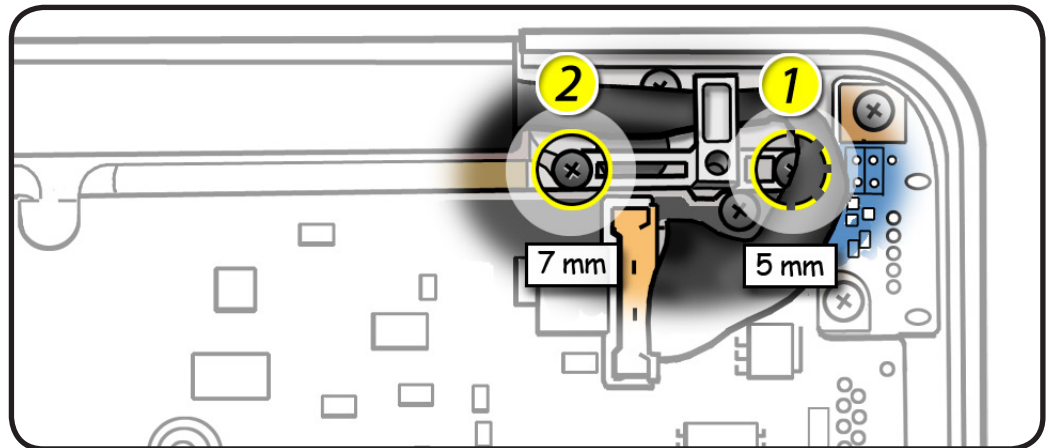
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver





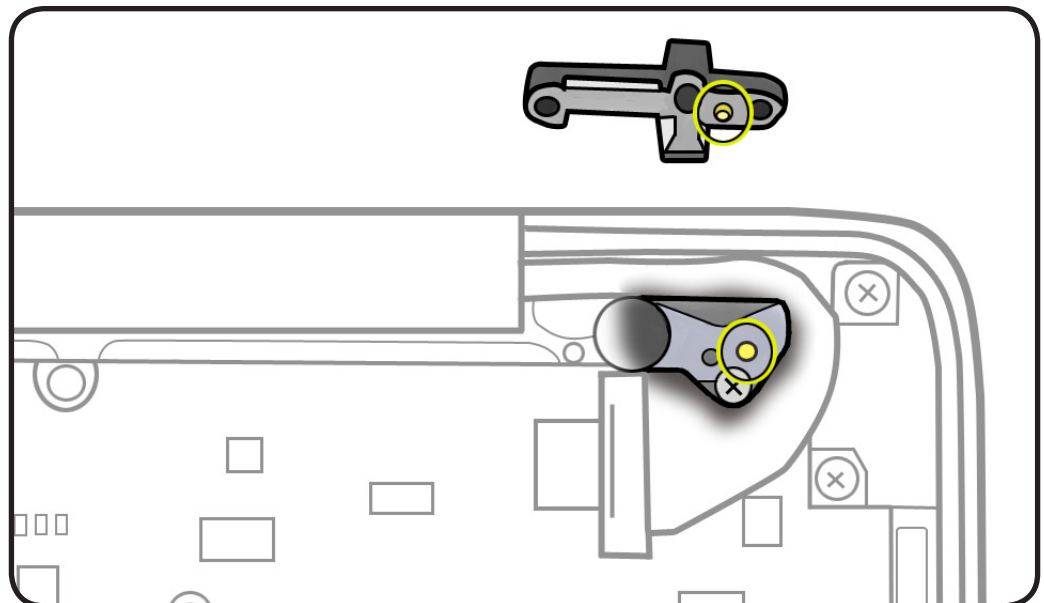
## Removal

- 1** Remove 2 screws:
- 5-mm in corner (922-8658)
  - 7-mm (922-8645)



- 2** Lift out cable guide.

**Replacement Note:** Align locator pin to hole in top case.







# Display Assembly

## First Steps

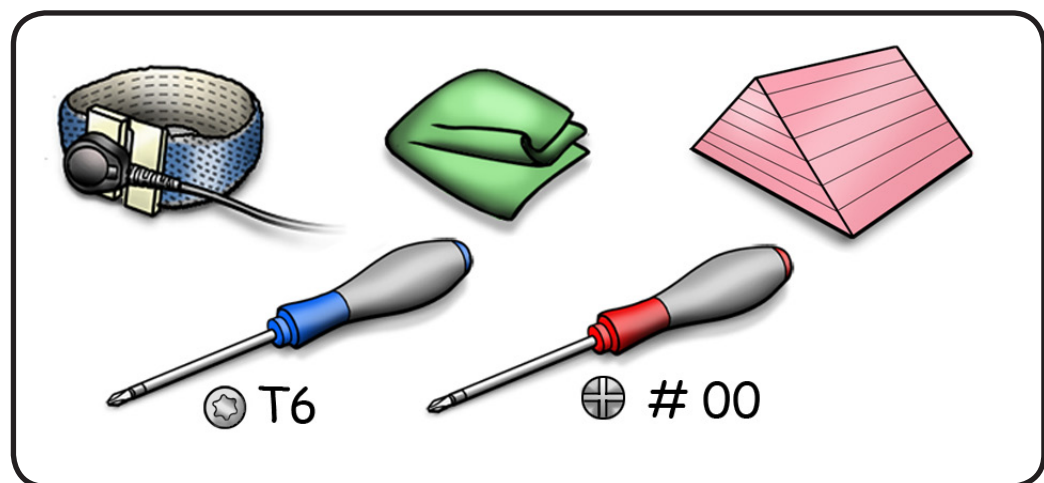
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Camera cable guide](#)
- [LVDS cable guide](#)



## Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
- Torx T6 screwdriver
- Foam wedge fixture

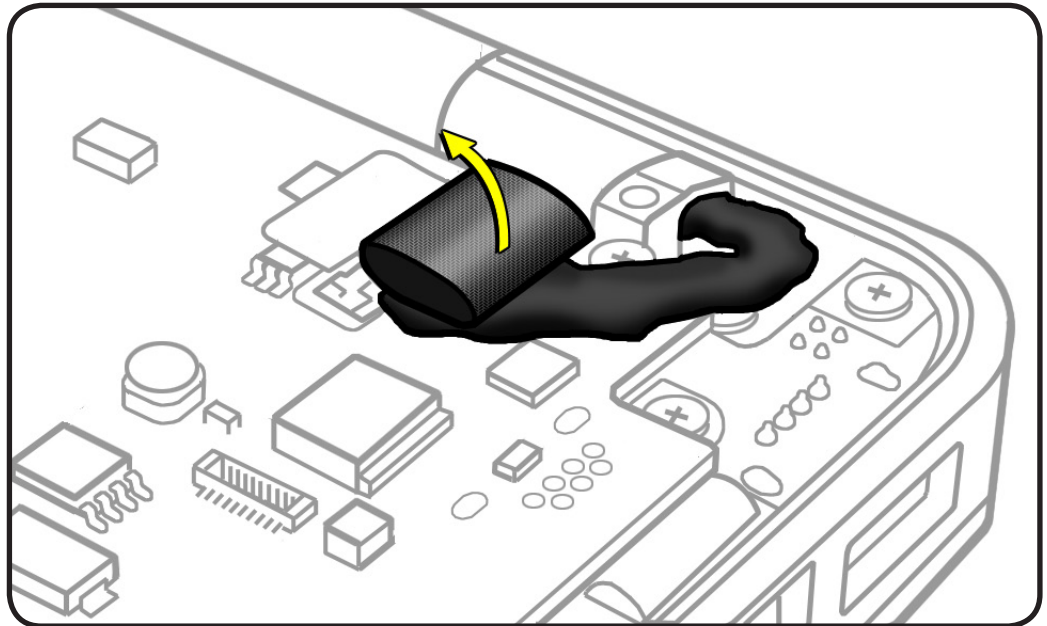




## Removal

1. Close display and place on soft cloth.
2. In the direction shown, peel off foam gasket from the LVDS connector.

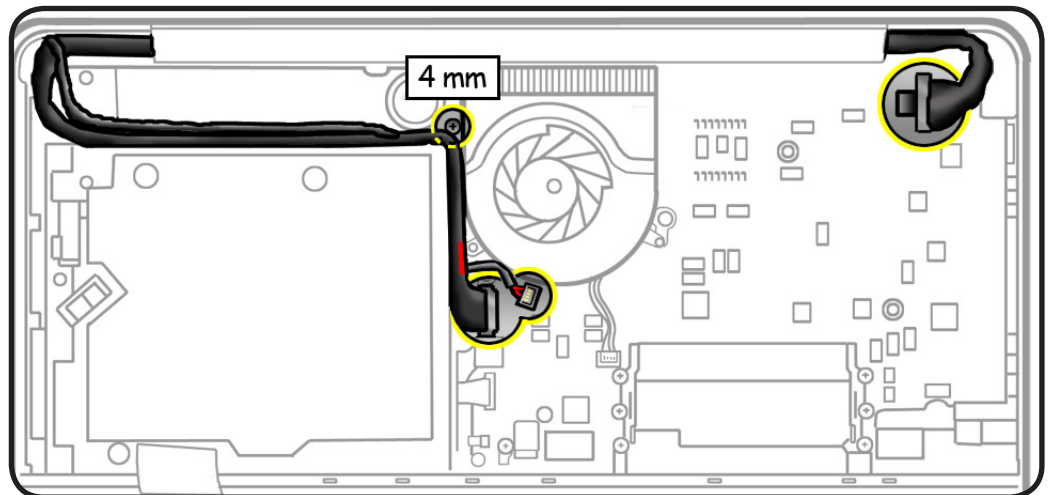
**Caution:** Refer to [Connector Types](#) before disconnecting cables.



3. Disconnect and unroute 3 cables:

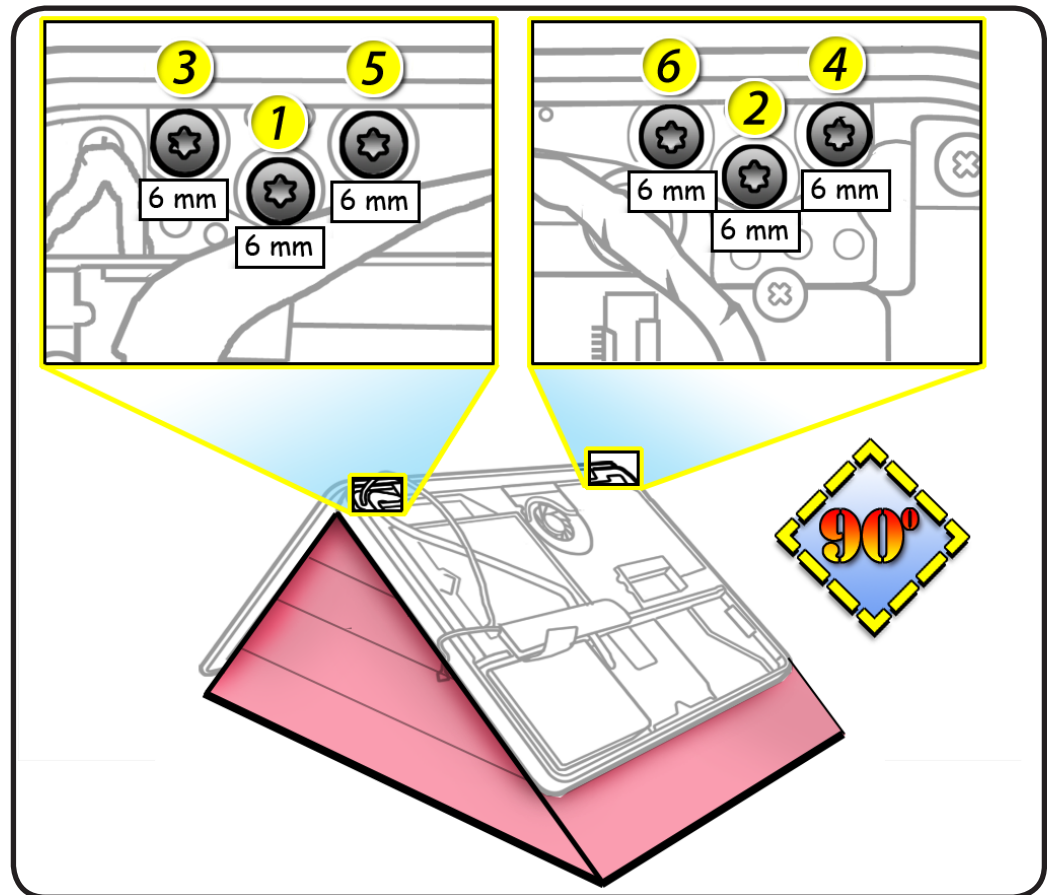
- subwoofer
- camera
- LVDS

4. Remove 4-mm screw (922-8644) from the subwoofer.





5. Without straining the subwoofer cable, rotate the subwoofer away from the right corner.
6. Open the display to 90 degrees, and place the computer on the foam wedge fixture.
7. Remove 6 (6-mm) Torx 922-8756 screws:  
  
**Replacement Note:**  
Install screws 1/2 way first; then tighten screws in the order shown.
8. Separate display assembly from top case.

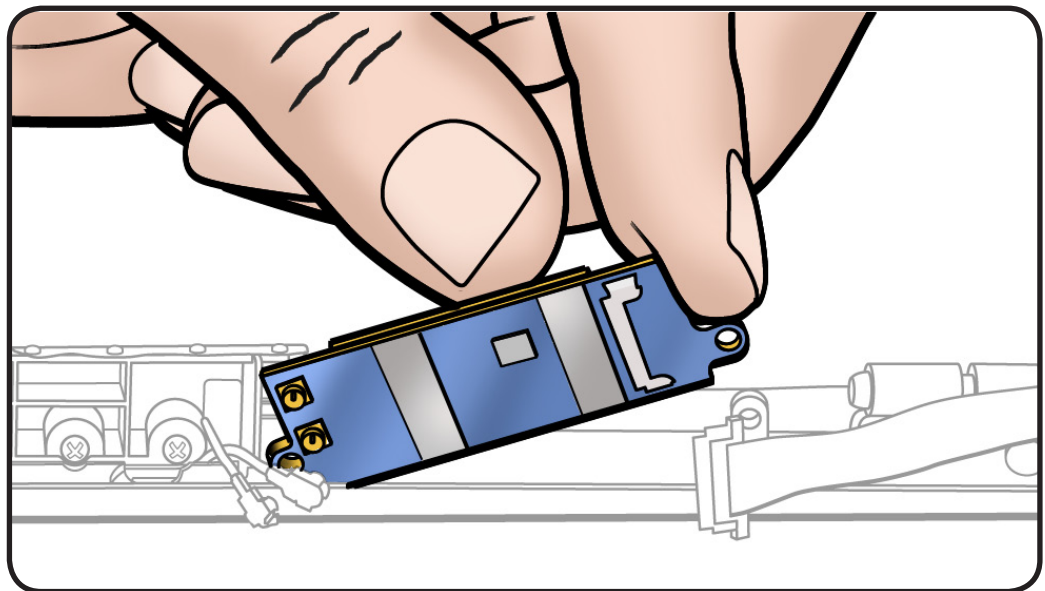


## Replacement

**Important:** Before returning a display assembly, be sure to

- remove [clutch cover](#)
- remove [AirPort Card](#), apply new thermal pad, and transfer card to the new display assembly
- reinstall [clutch cover](#)

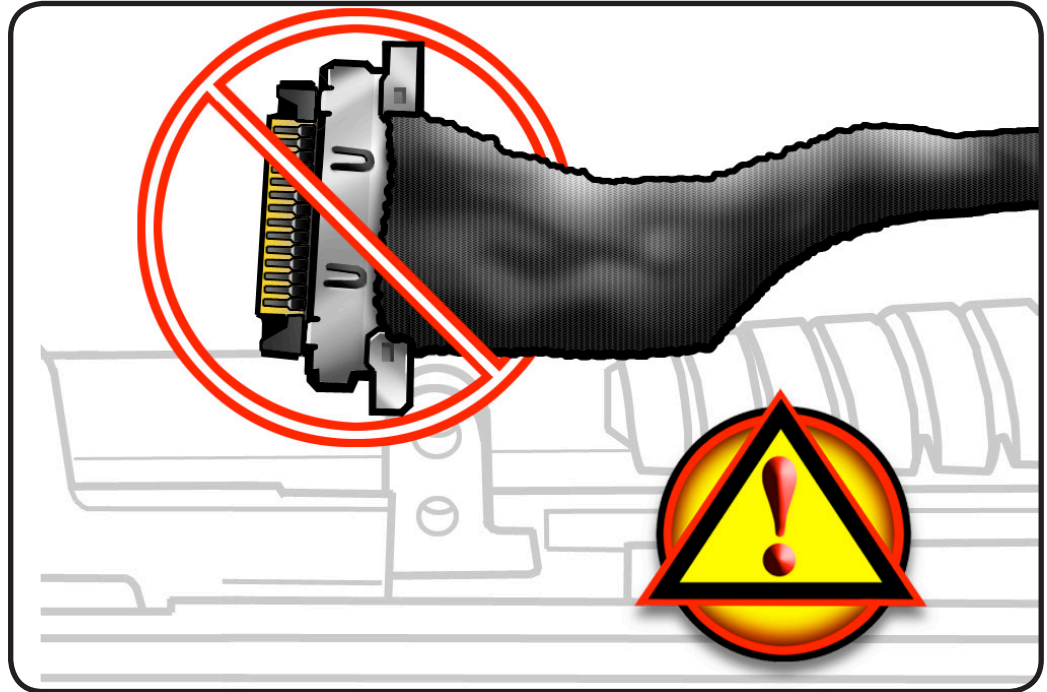
**Important:** Before installing a new display assembly, be sure to install the [AirPort Card](#).





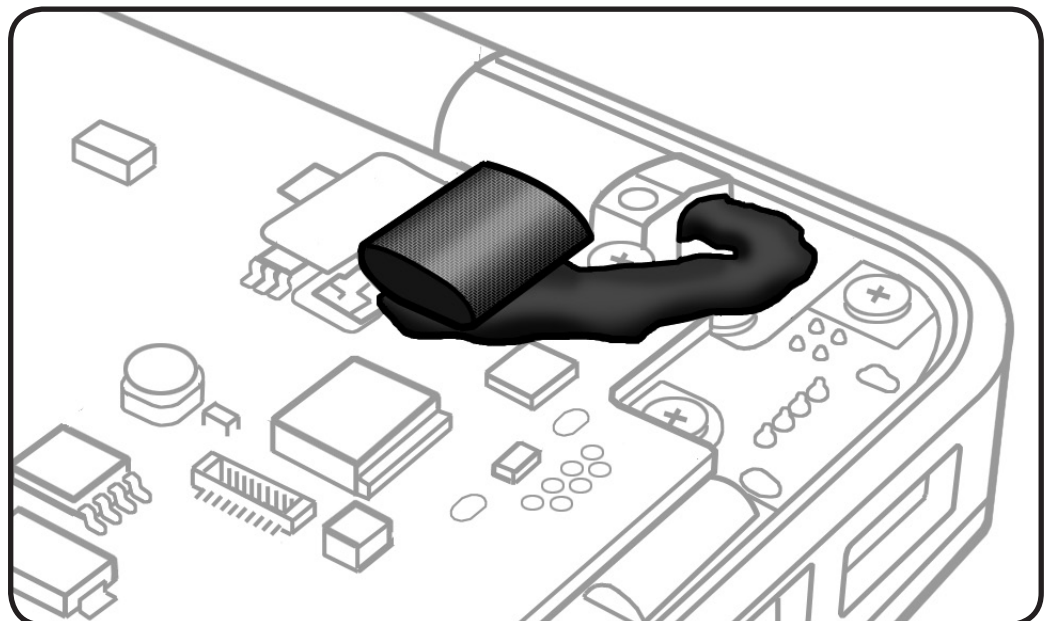
**Important:** Check the AirPort cable. At the end of the cable, on the metal part, there are two grounding fingers (two U-shaped marks). Orient the grounding fingers so they are facing the AirPort card and are in contact with the AirPort card connector. The grounding fingers should **NOT** be facing you. Inserting the cable incorrectly will cause logic board failure!

With the computer assembled, test the AirPort card for normal operation.



**Replacement Caution:**

To prevent video “noise,” a whining sound, no video, or a short to the logic board, be sure to place foam gasket on LVDS connector—**positioned precisely where shown**—**after** cable is fully connected to logic board.





# Display Clutch Cover

## First Steps

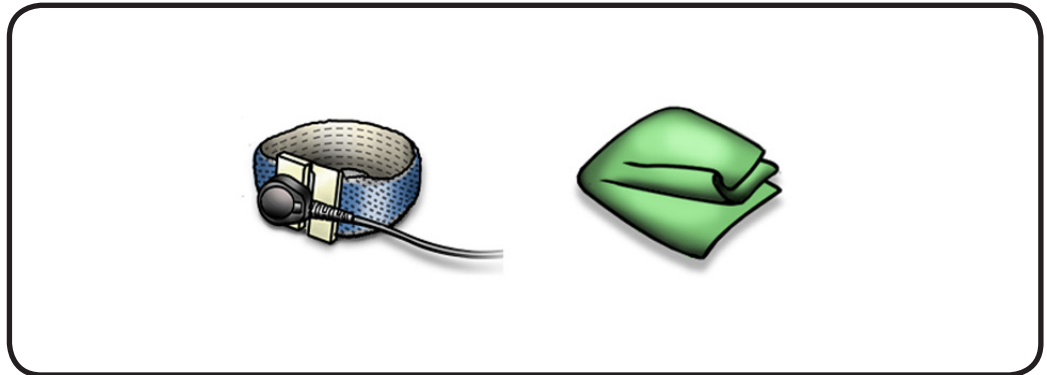
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Camera cable guide](#)
- [LVDS cable guide](#)
- [Display assembly](#)



## Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat

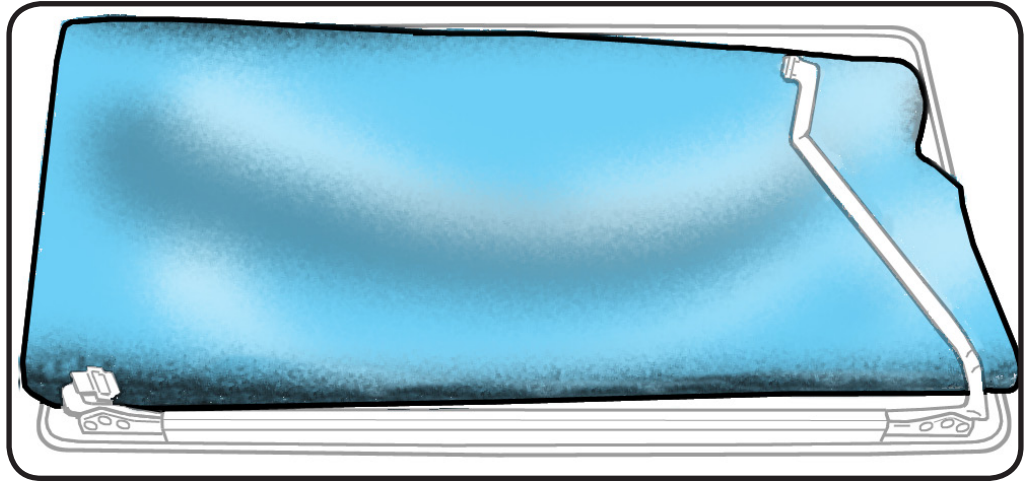






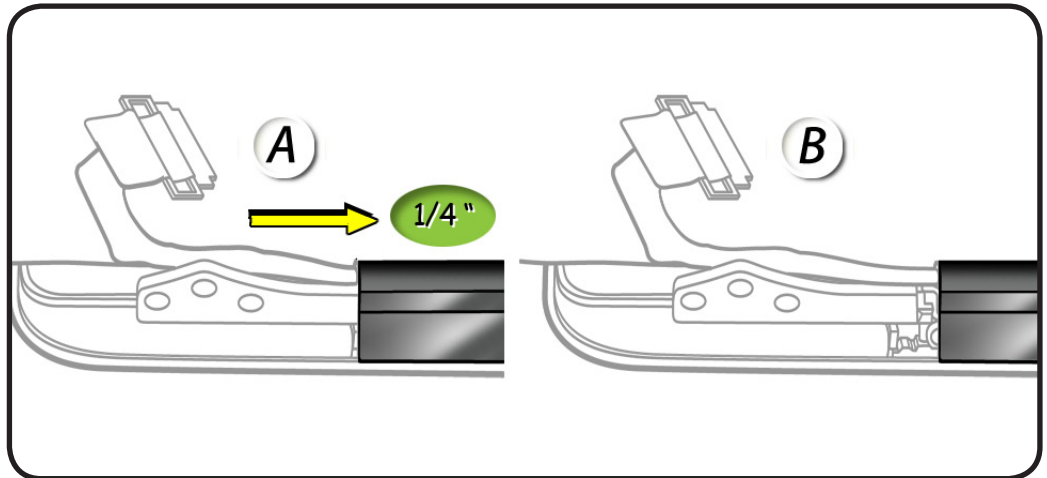
## Removal

- 1 Cover display face with clean, soft cloth.



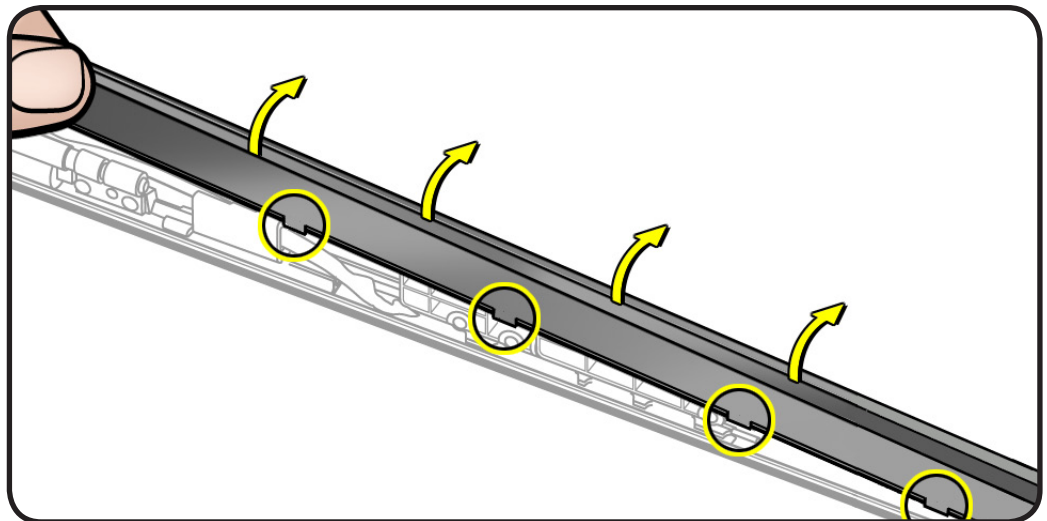
- 2 Holding left hinge, slide clutch cover 1/4 inch (6.35 mm) away from the LVDS cable.

- 3 Press down on clutch cover to loosen 4 hooks inside.



- 4 Tilt up end of clutch cover as you **roll it toward display face**.

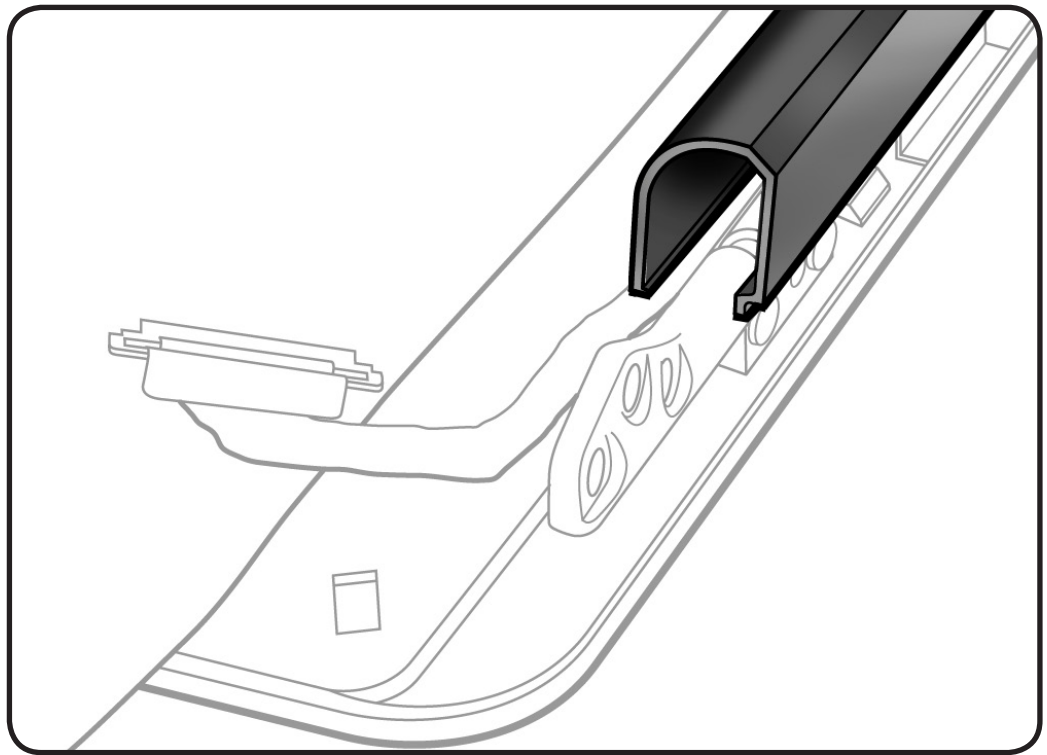
- 5 Remove clutch cover.



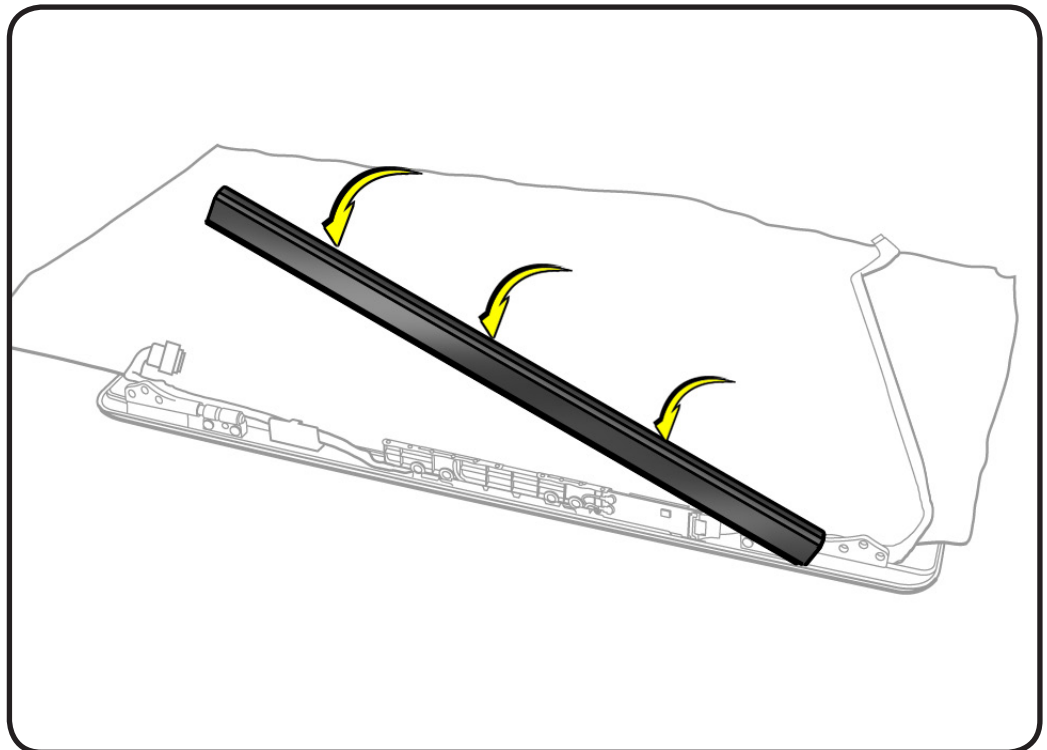


## Replacement

- 1 Note shape of clutch cover:
  - flat at bottom
  - curved at top
- 2 Make sure flat edge is at bottom of display.



- 3 Tilt clutch cover onto end with longer cable.
- 4 Lower clutch cover onto display assembly.
- 5 Listen for snapping sound as hooks engage.
- 6 Check for good fit.  
Avoid:
  - gaps
  - bulges
  - pinched cables



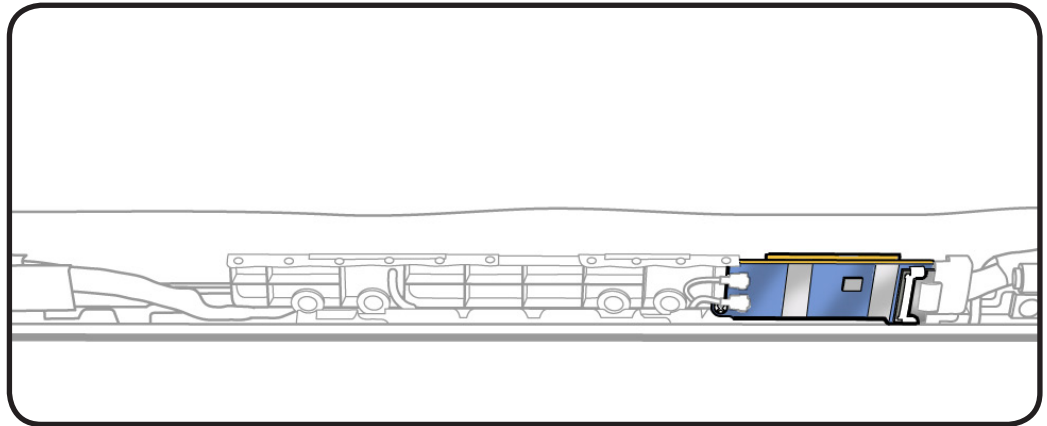


# AirPort Card

## First Steps

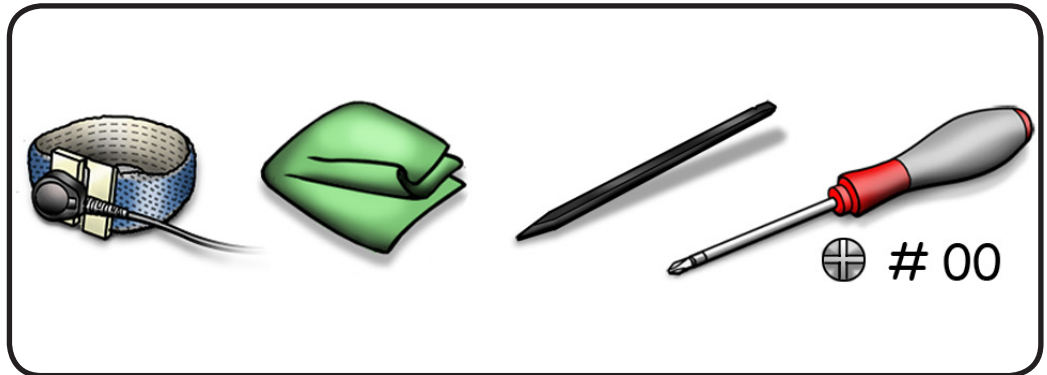
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Camera cable guide](#)
- [LVDS cable guide](#)
- [Display assembly](#)
- [Display clutch cover](#)



## Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Black stick
- Phillips #00 screwdriver



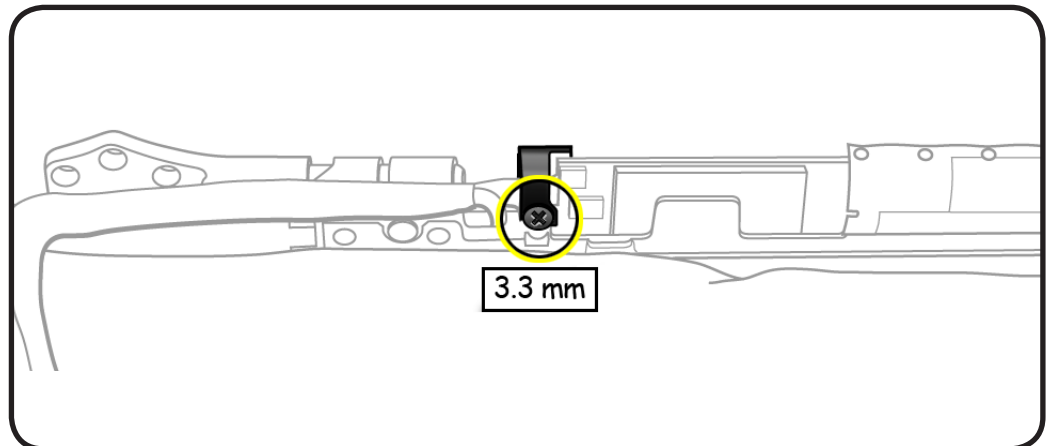




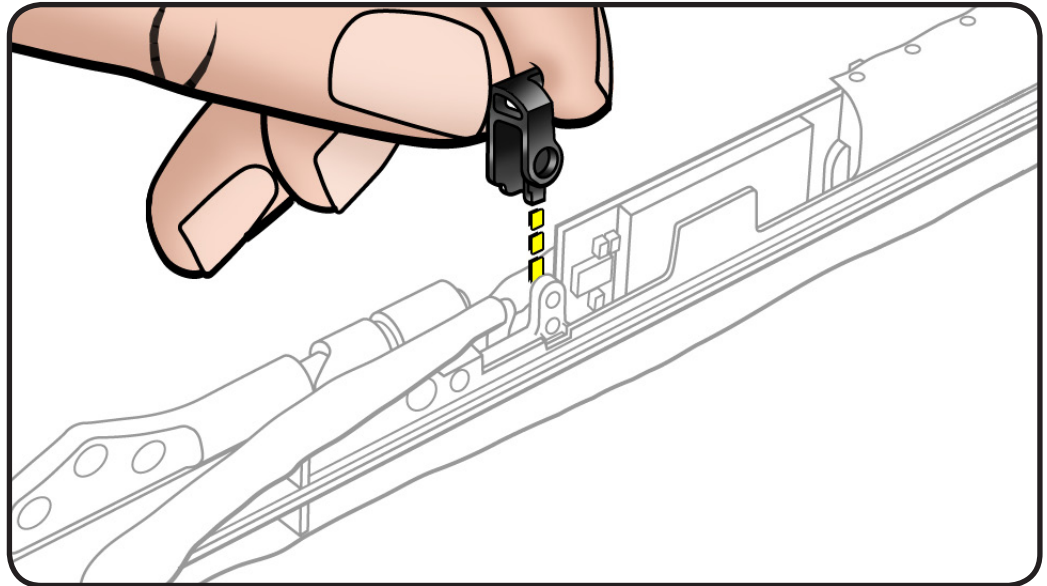
## Removal

- 1 Cover display with clean, soft cloth.
- 2 Remove 3.3 mm screw (076-1326) from cable clip.

Note the wide head on this screw.



- 3 Lift up cable clip.

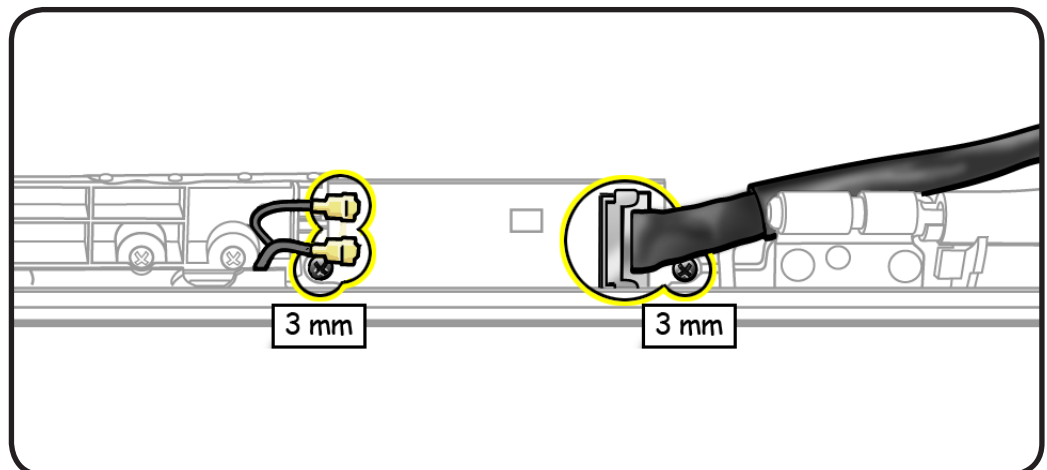


- 4 Disconnect AirPort cable.

- 5 Disconnect 2 AirPort antenna cables.

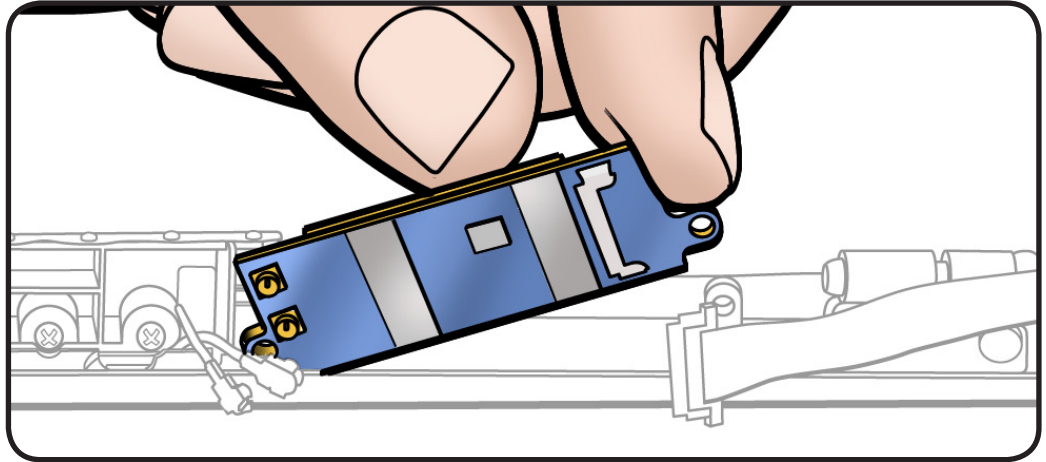
**Replacement Note:**  
Shorter cable is at bottom.

- 6 Remove 2 (3-mm) screws (076-1326).



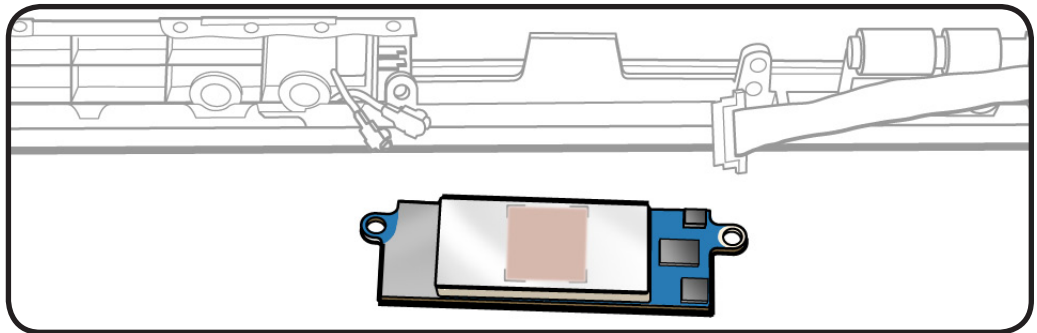


## 7 Lift out AirPort Card.

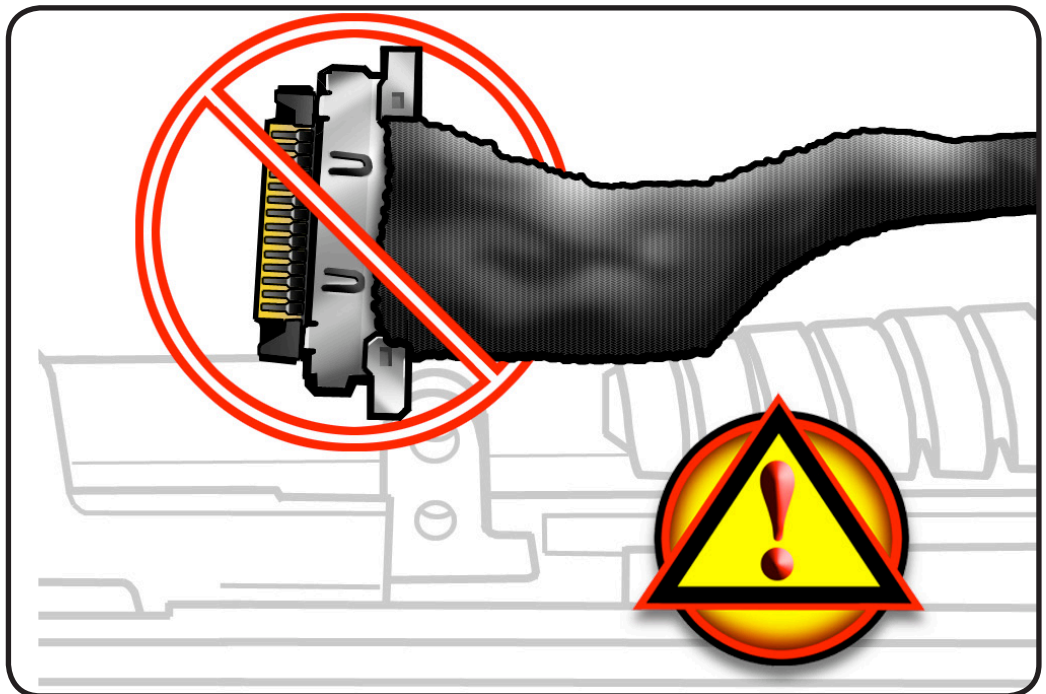


## Replacement

- 1 Make sure thermal pad is centered on AirPort Card within 4 corner guides. If the pad sticks to display assembly tab, scrape it away.

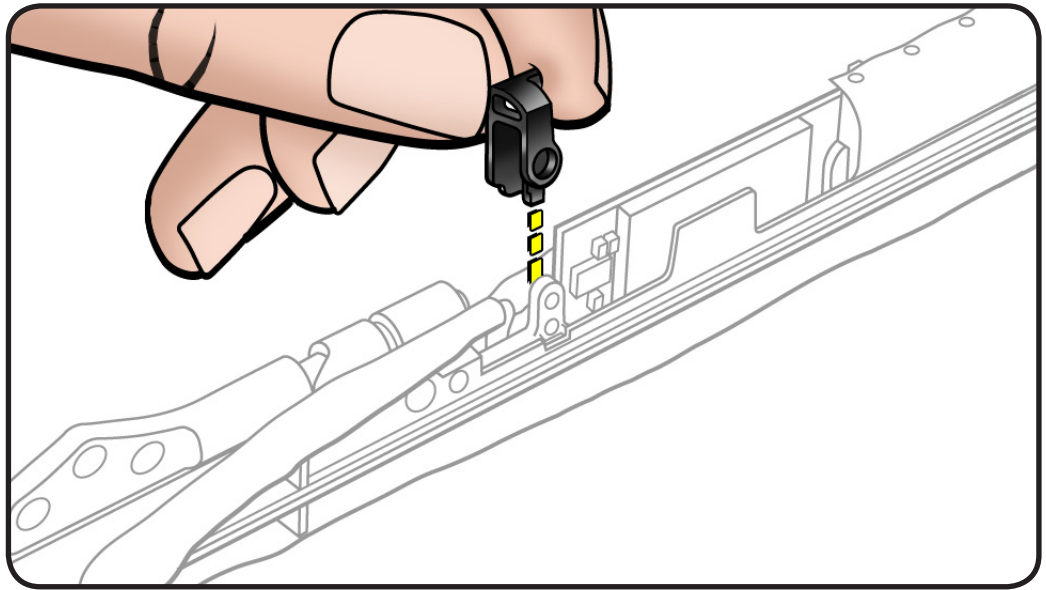


- 2 **Important:** Check the AirPort cable. At the end of the cable, on the metal part, there are two grounding fingers (two U-shaped marks). Orient the grounding fingers so they are facing the AirPort card and are in contact with the AirPort card connector. The grounding fingers should **NOT** be facing you. Inserting the cable incorrectly will cause logic board failure!





- 3 After installing the remaining connectors and screws, be sure to install the cable clip with the wider head screw.



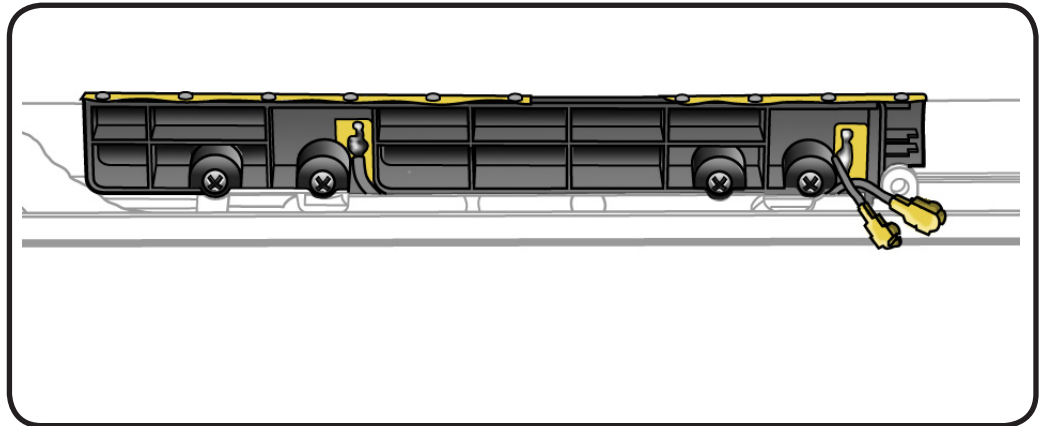


# AirPort Antenna

## First Steps

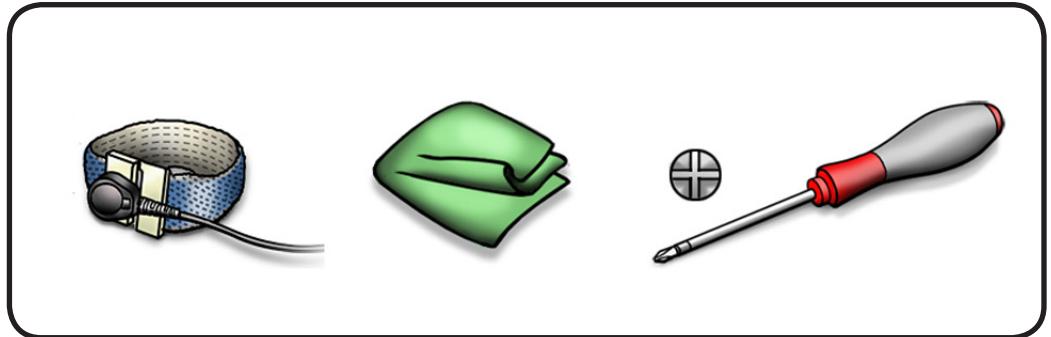
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Camera cable guide](#)
- [LVDS cable guide](#)
- [Display assembly](#)
- [Display clutch cover](#)
- [AirPort Card](#)



## Tools

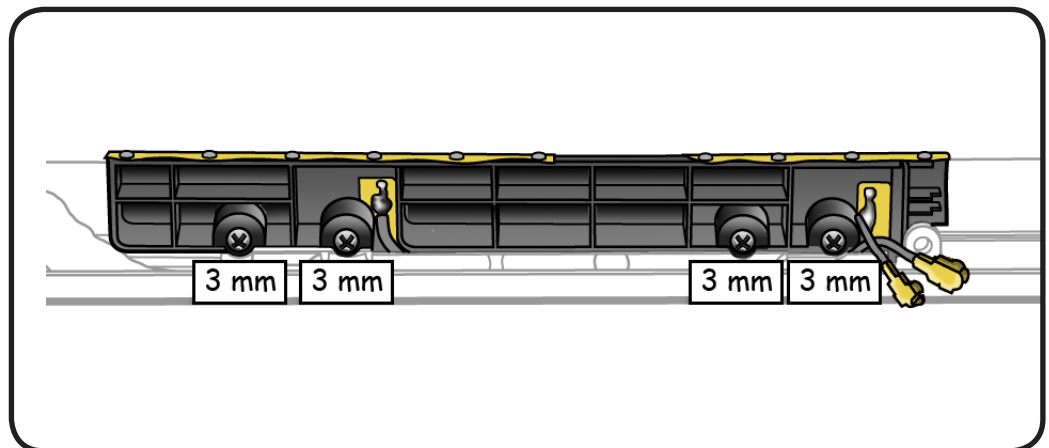
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver



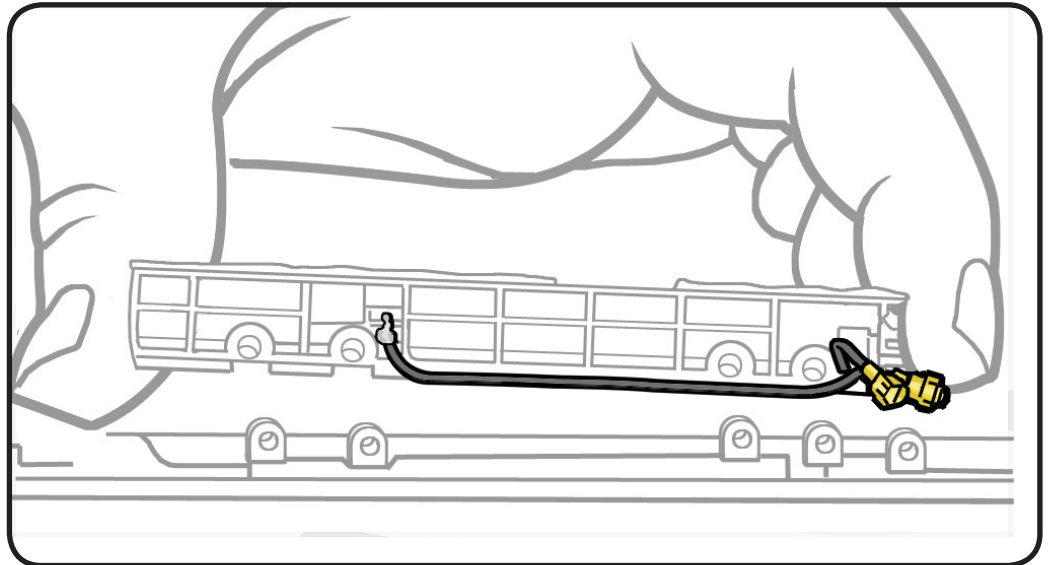


## Removal

- 1 Remove 4 ( 3-mm) screws (076-1326).
- 2 Lift out card.



**Replacement Note:** Make sure the AirPort antenna cable is routed in its channel.



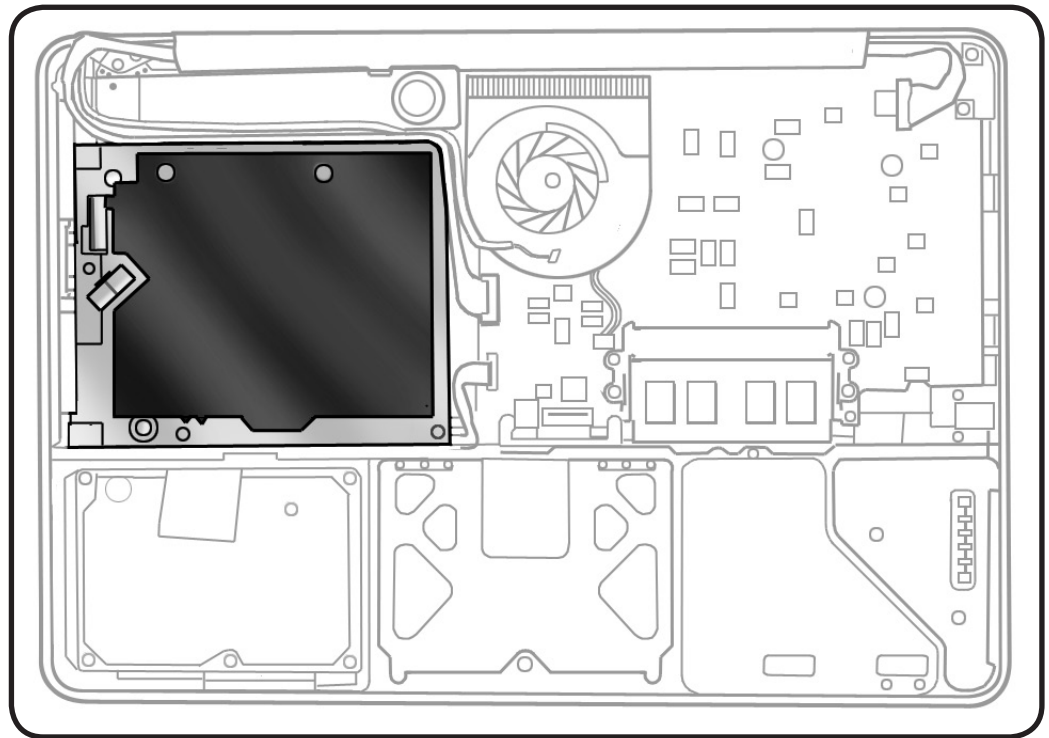


# Optical Drive

## First Steps

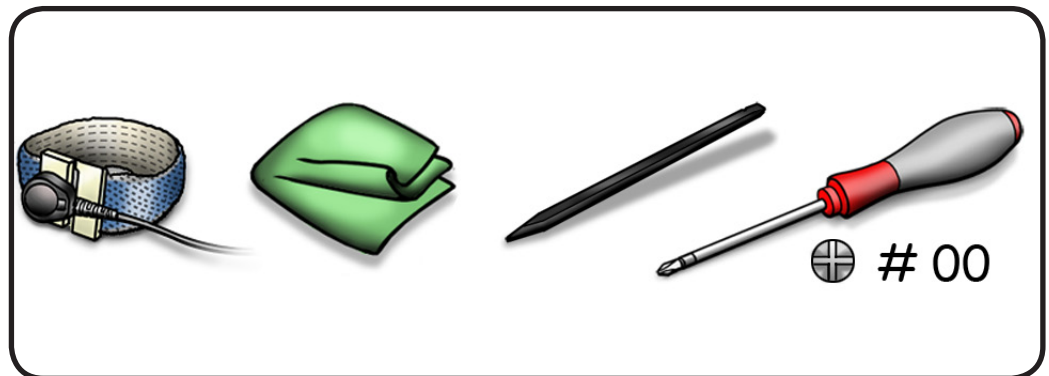
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Camera cable guide](#)



## Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
- Black stick





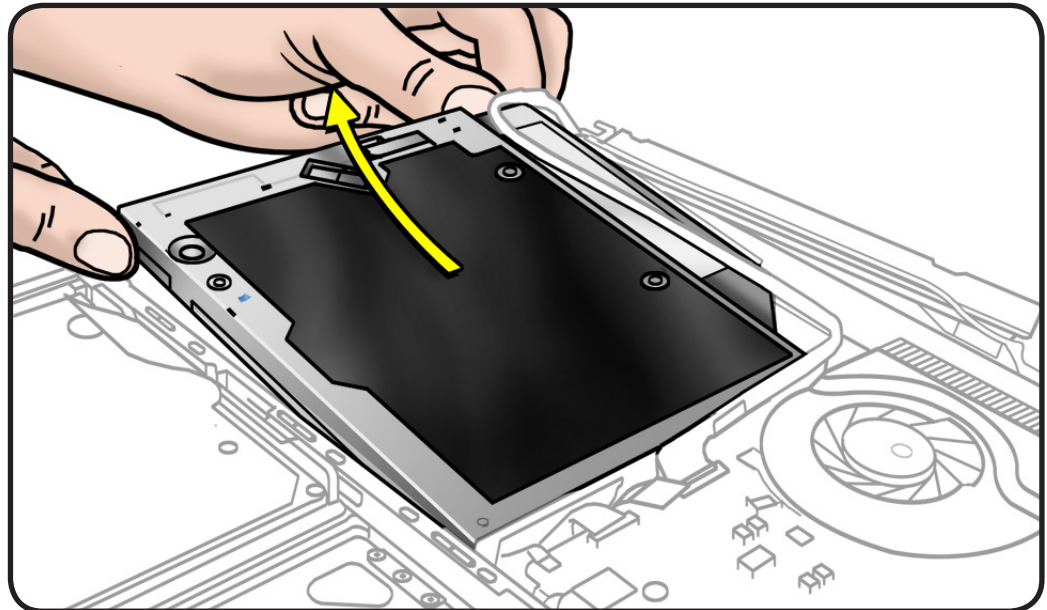
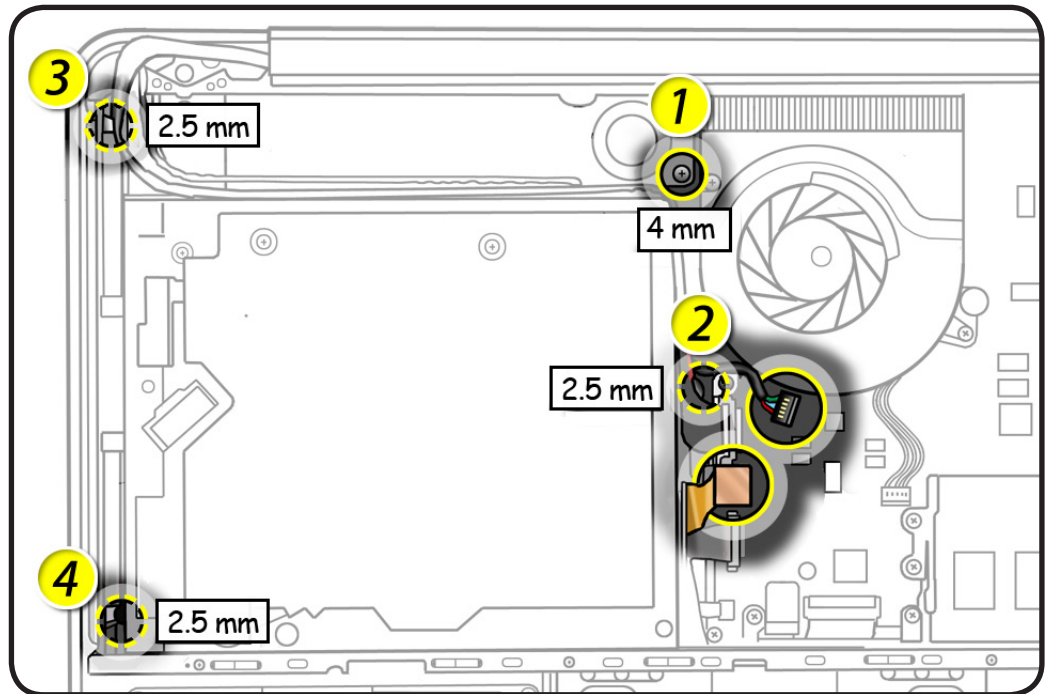
## Removal

- 1** Disconnect cables:
  - subwoofer
  - camera
- 2** Remove screws:
  - 1 (4-mm) subwoofer (922-8650)
  - 3 (2.5-mm) optical drive (922-8662)
- 3** Use black stick to carefully disconnect optical drive flex cable.

Press cable straight down when installing.



- 4** Tilt up drive to remove.

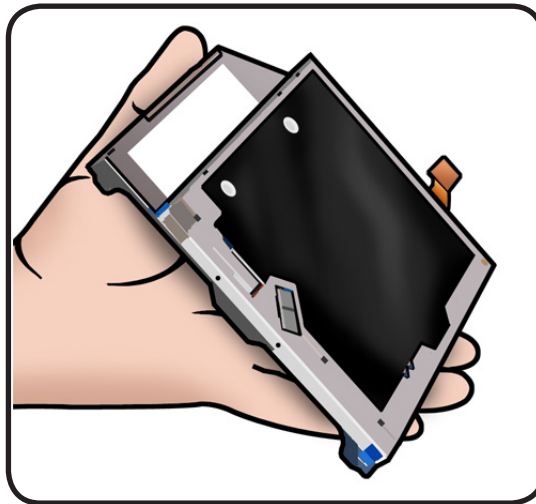






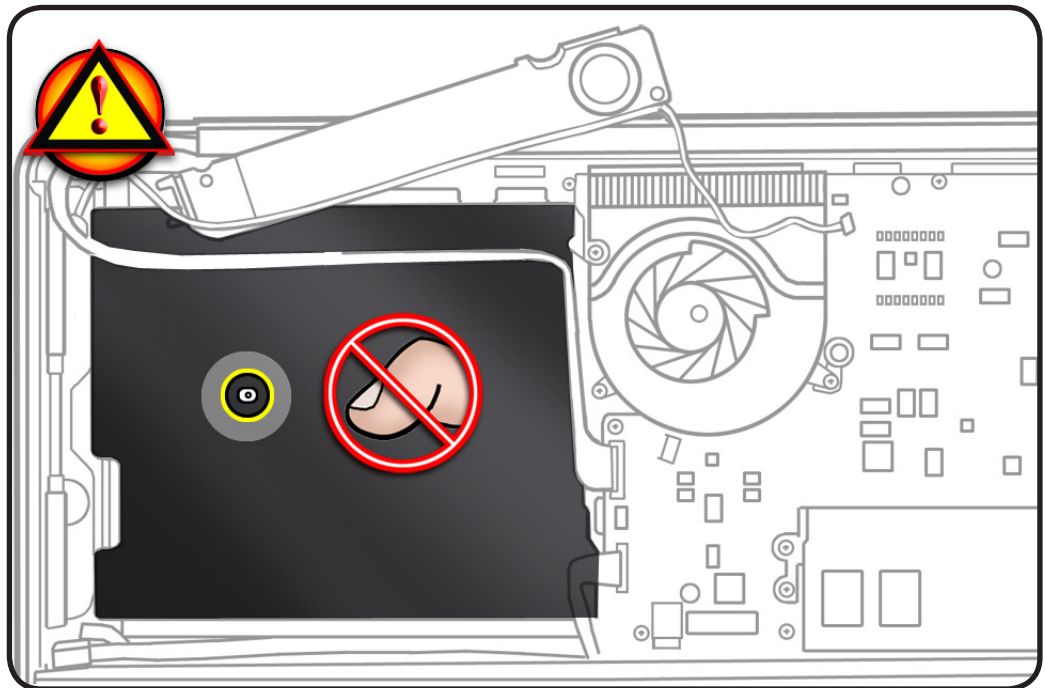
**5** Handle drive by sides.

**6** If replacing optical drive, make sure it has flex cable.



## Replacement

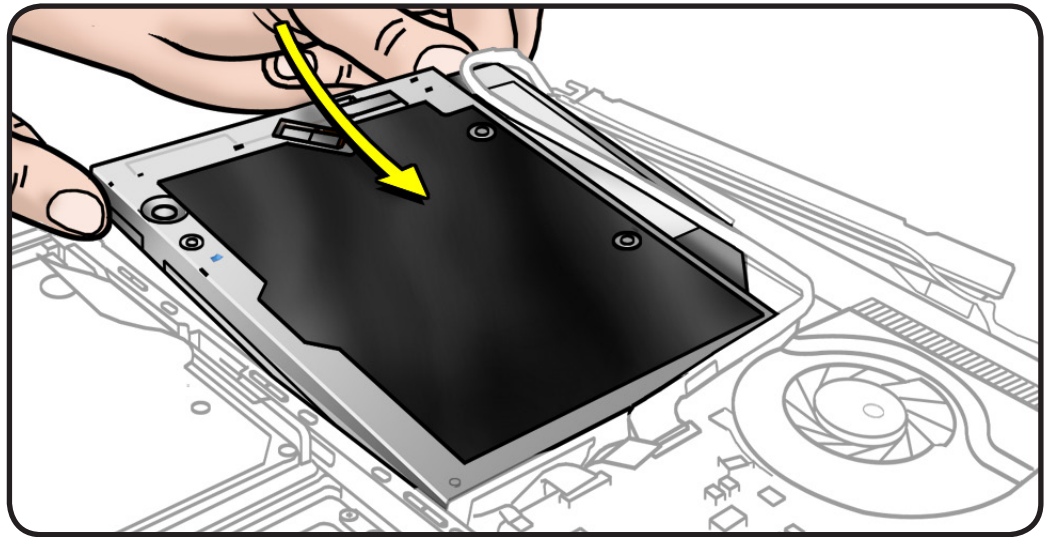
**1** Do not touch sensor on top case.







- 2 If installing a new optical drive, make sure it has the flex cable attached.
- 3 Tilt optical drive into top case, making sure cables are out of way..



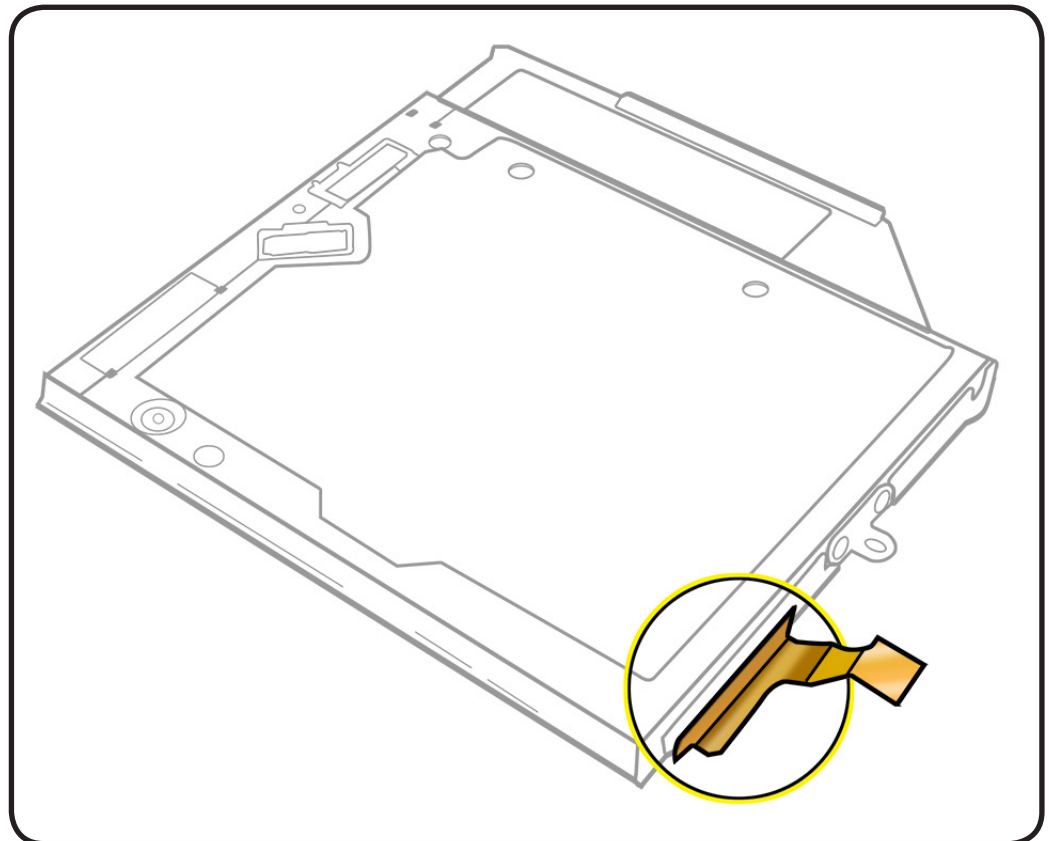


# Optical Drive Flex Cable

## First Steps

Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Camera cable guide](#)
- [Optical drive](#)



## Tools

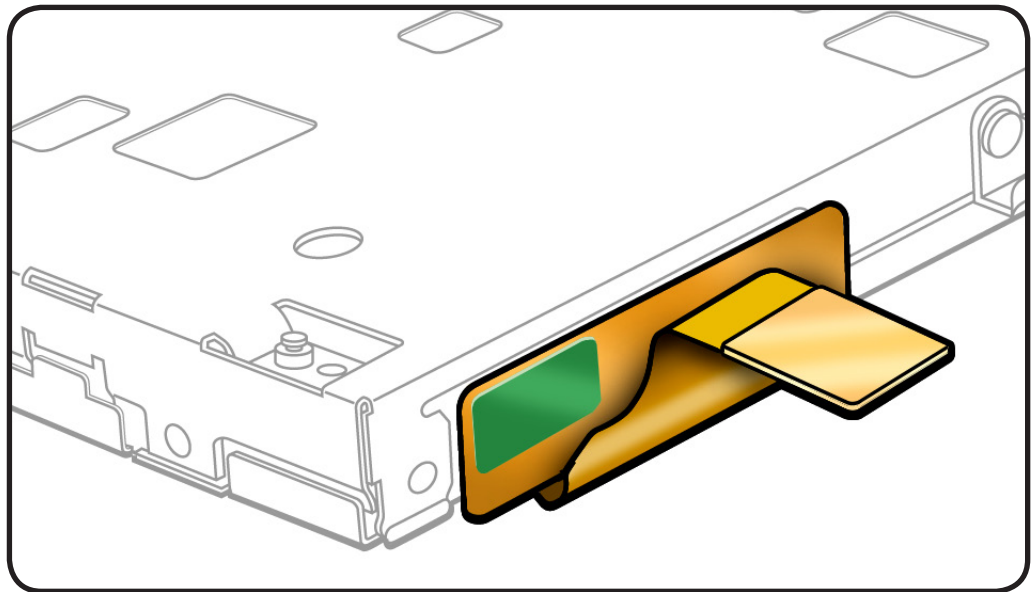
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Black stick





## Removal

- 1 Handle drive by sides.
- 2 Evenly disconnect optical drive flex cable.



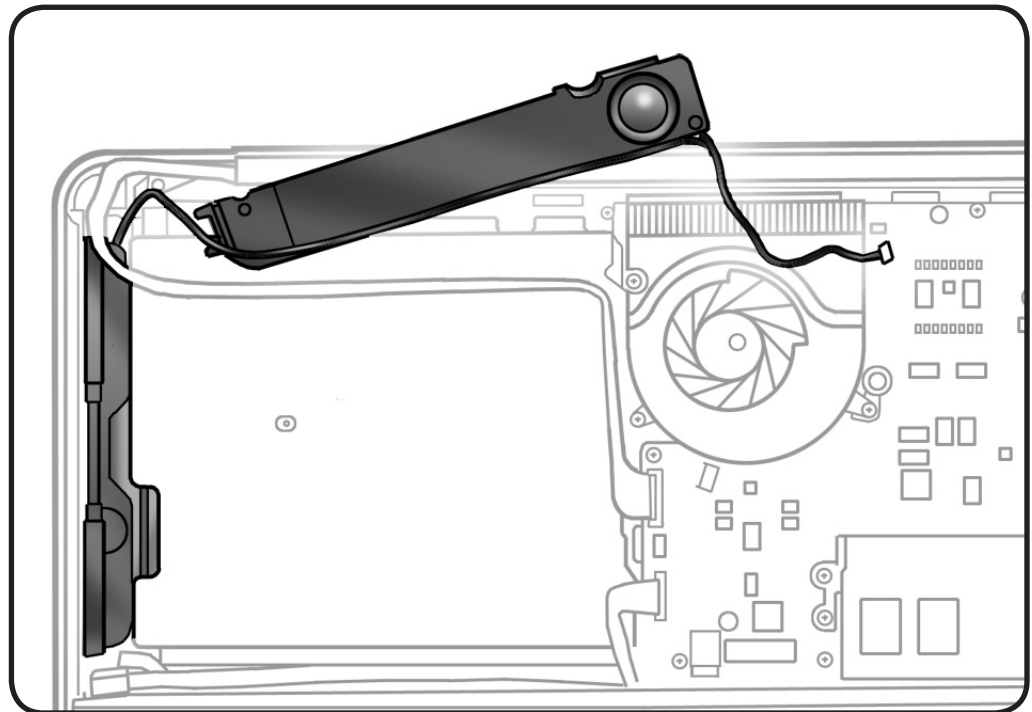


# Right Speaker / Subwoofer

## First Steps

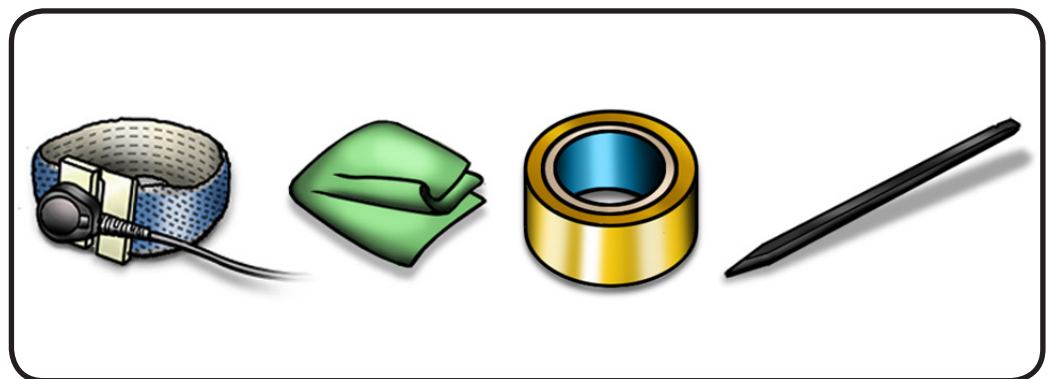
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Camera cable guide](#)
- [Optical drive](#)



## Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Black stick
- Kapton tape

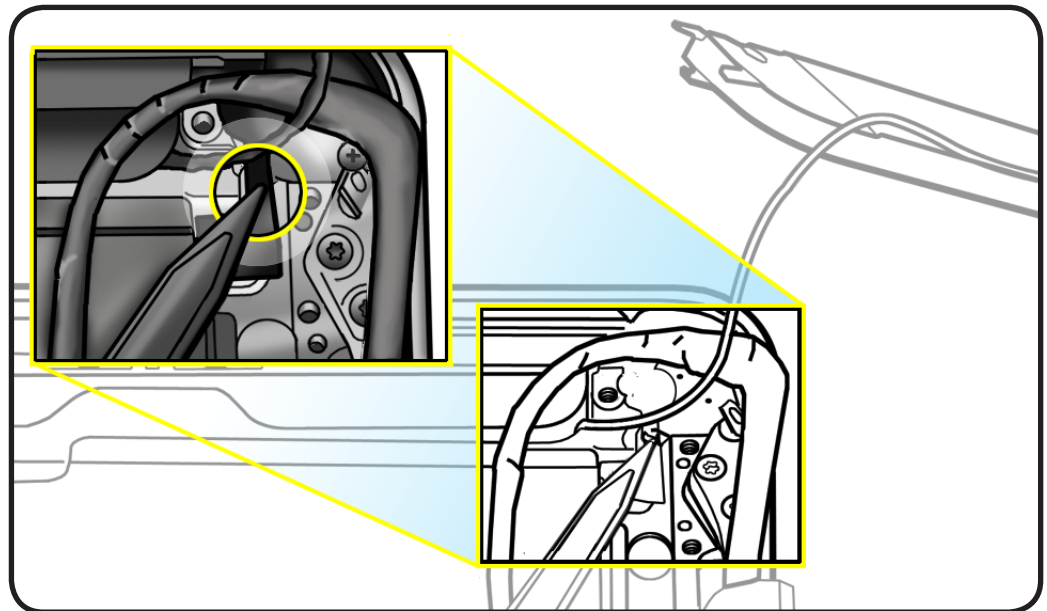




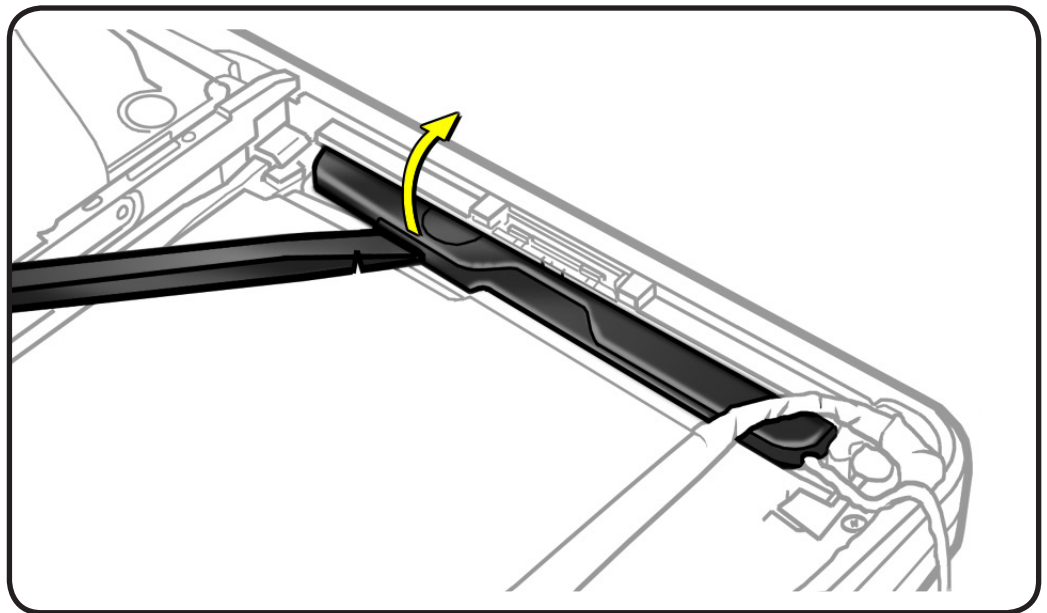
## Removal

- 1 Break black tape to free subwoofer cable.

**Replacement Note:**  
Apply Kapton tape.



- 2 Pry up speaker body to loosen adhesive.

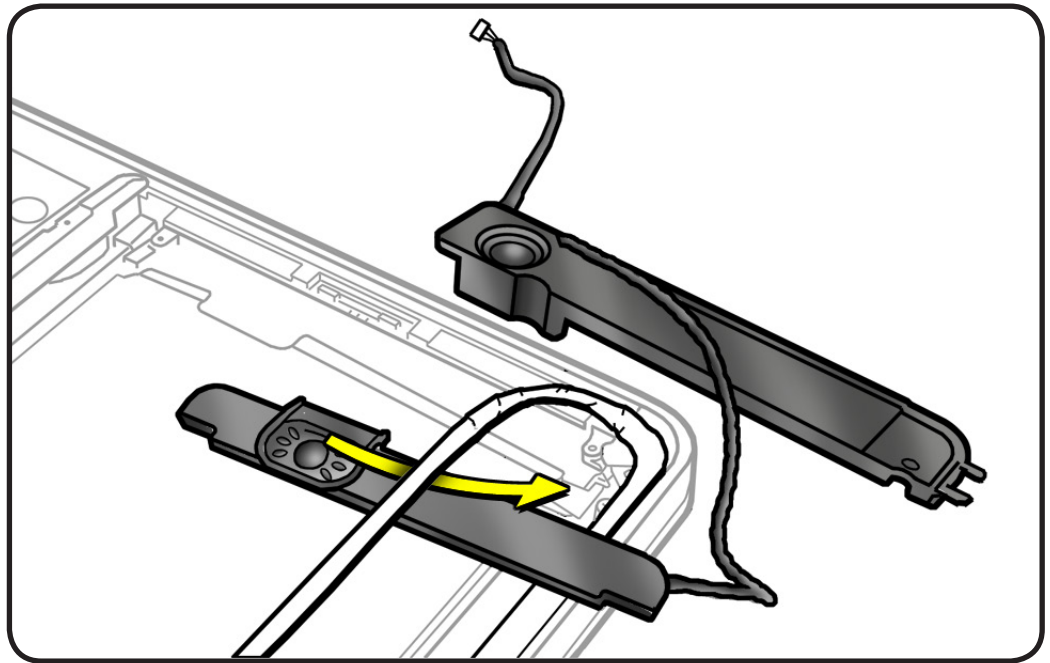




- 3 Route speaker under display cable.

## Replacement

- 1 Peel adhesive backing off right speaker and install in top case.
- 2 To finish installing subwoofer, follow steps in
  - [Optical drive](#)
  - [Camera cable guide](#)



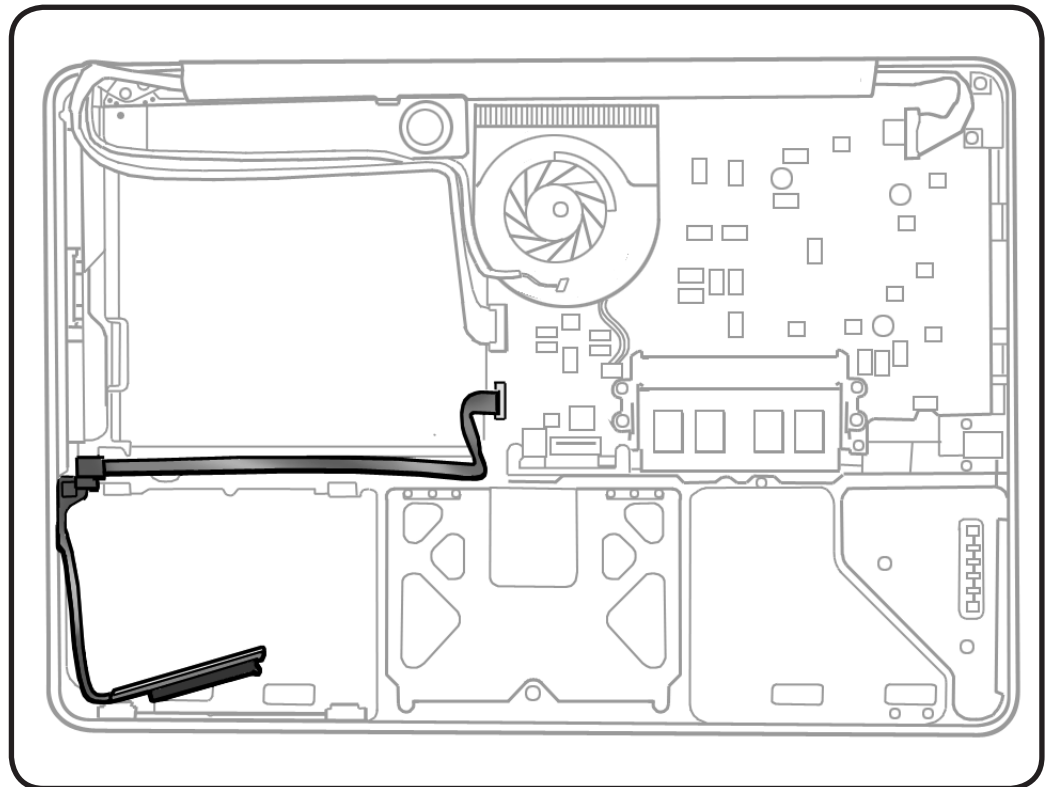


# Hard Drive Connector Cable

## First Steps

Remove:

- [Access door](#)
- [Battery](#)
- [Hard drive](#)
- [Bottom case](#)
- [Mid wall](#)
- [Camera cable guide](#)
- [Optical drive](#)



## Tools

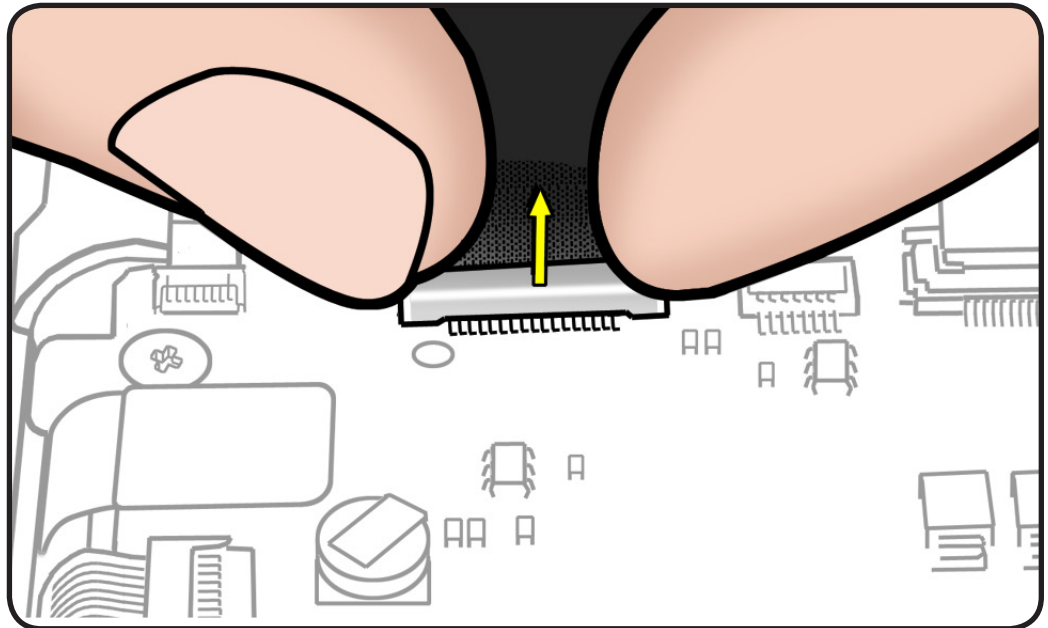
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Black stick



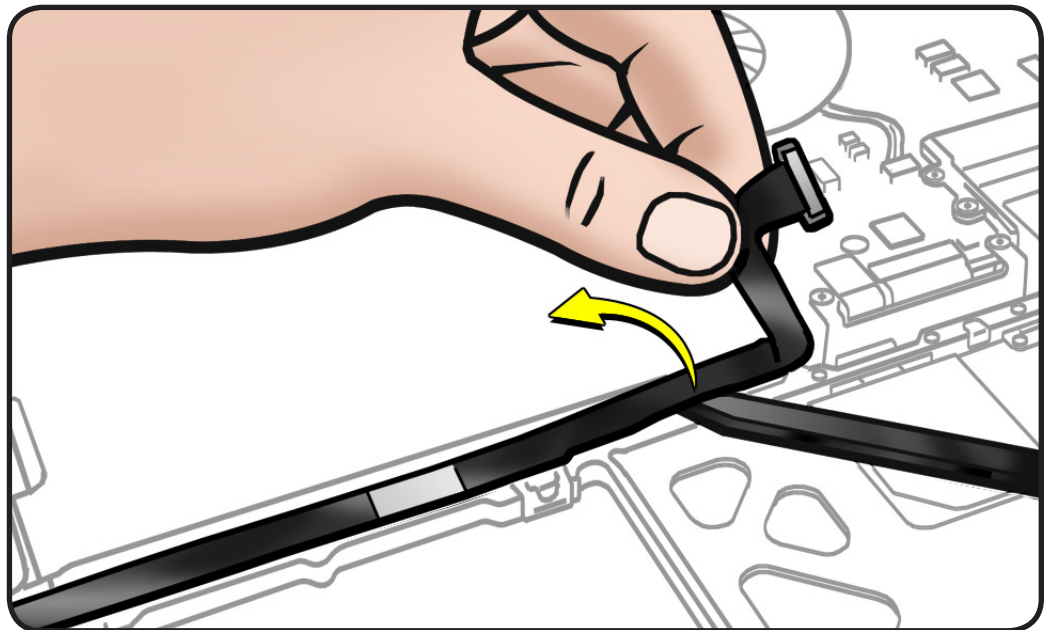


## Removal

- 1 Pull straight up on connector to disconnect cable.



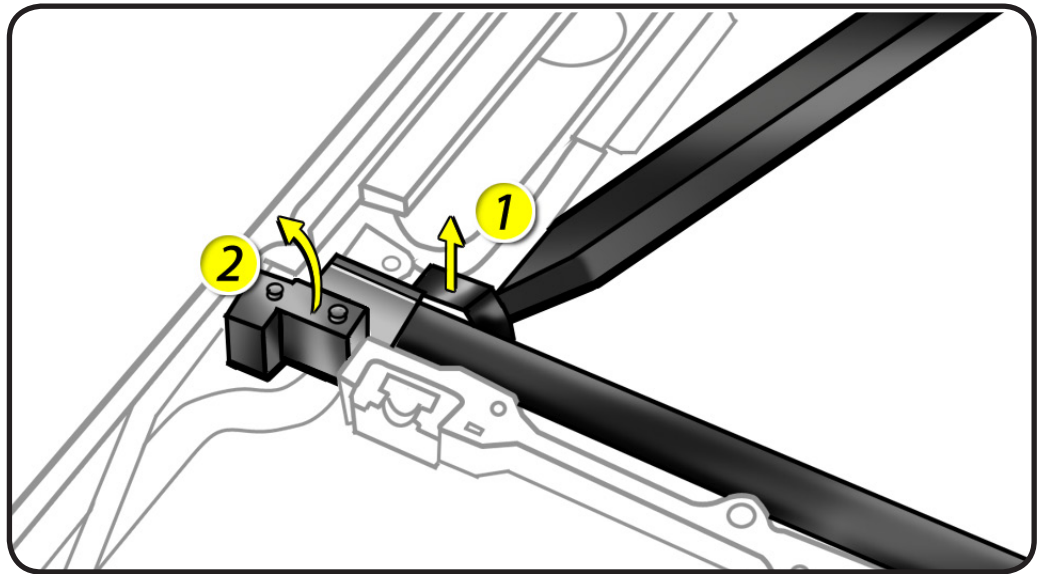
- 2 Peel up cable from top case.





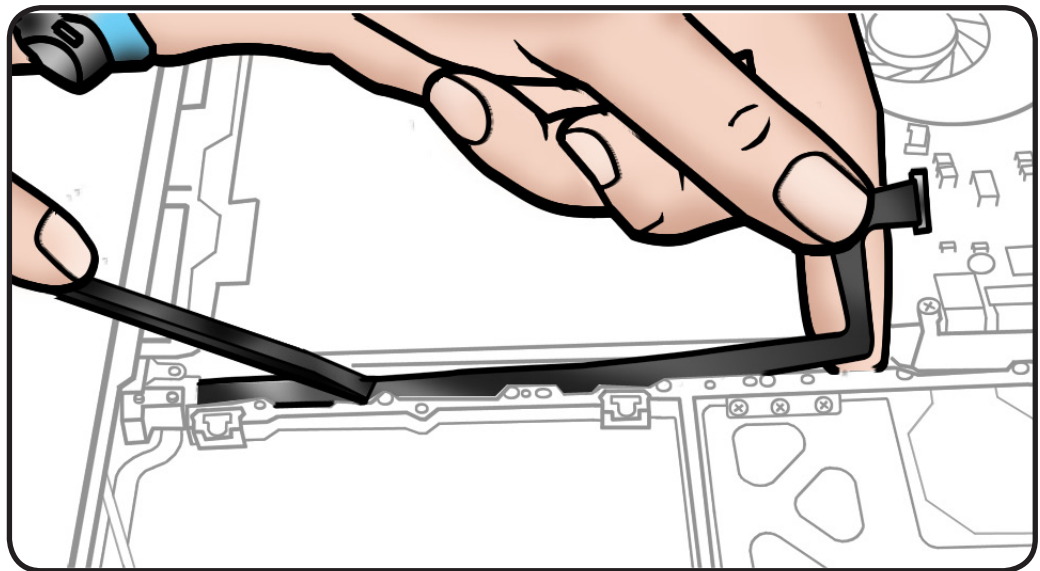


- 3 Lift up adhesive tab.
- 4 Twist strain relief out of top case.



## Replacement

- 1 Peel adhesive backing off cable.
- 2 Press cable so it lays flat in top case.
- 3 Connect cable to
  - logic board
  - top case
  - hard drive



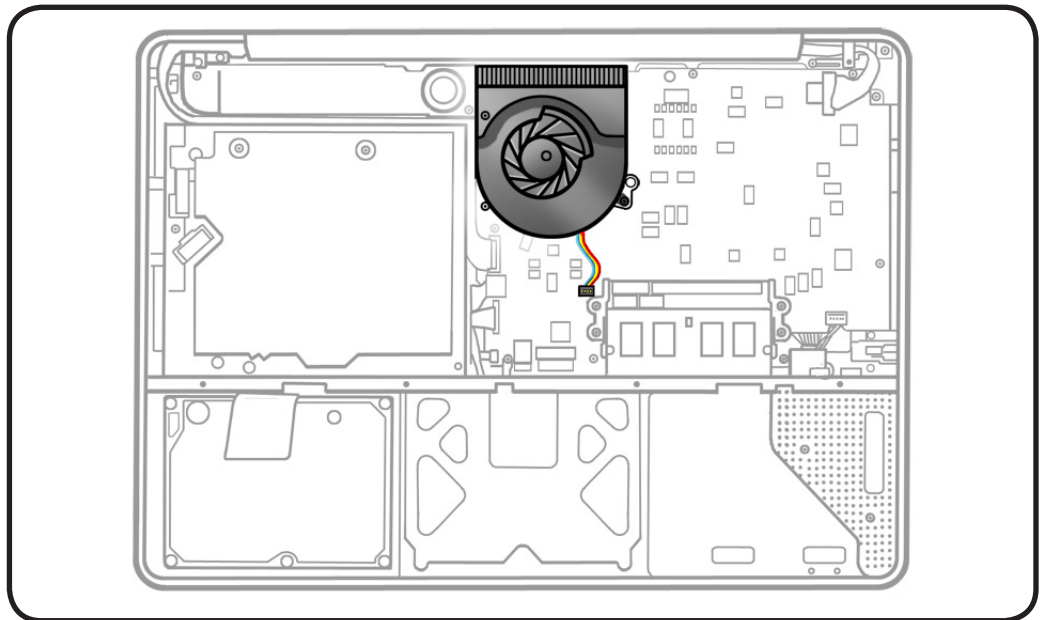


# Fan

## First Steps

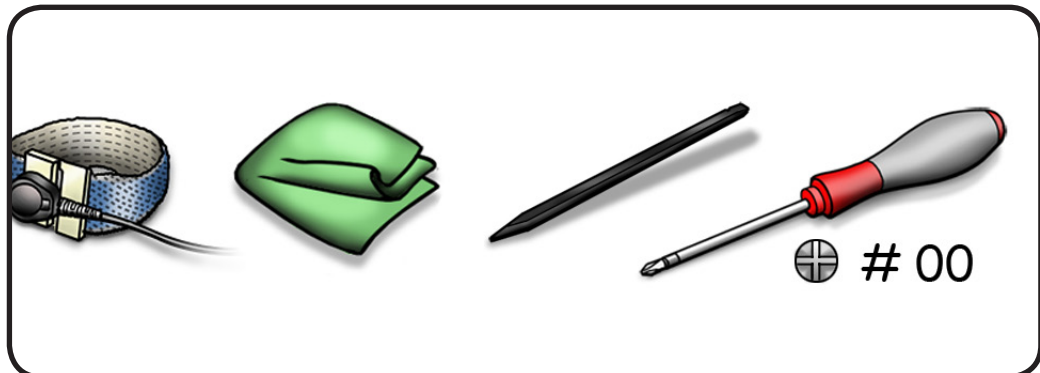
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)



## Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
- Black stick





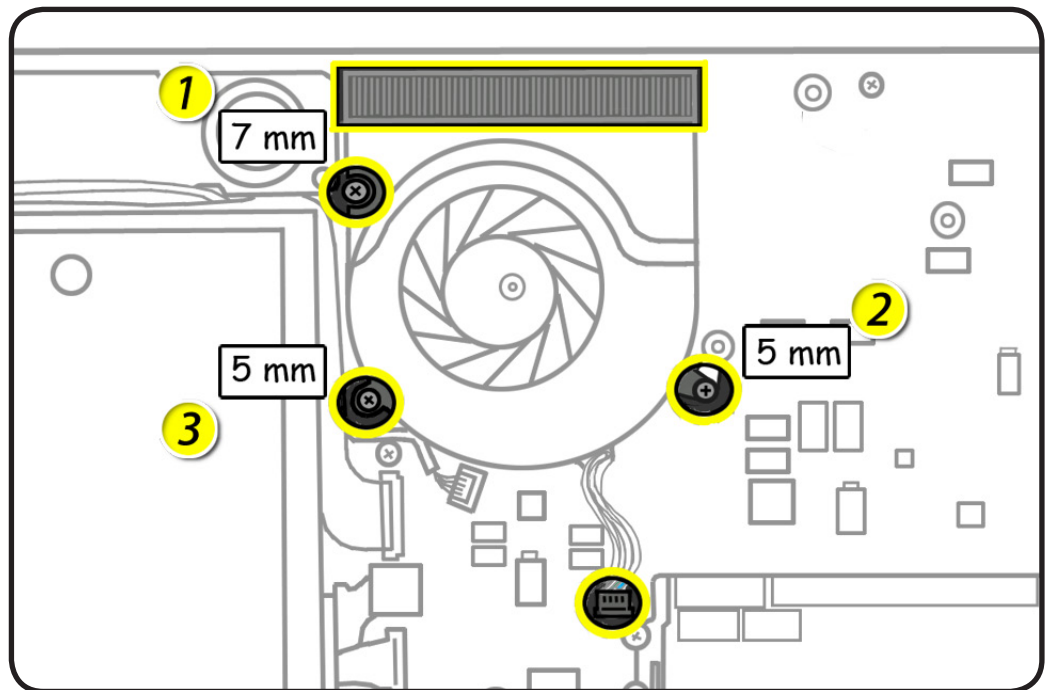
## Removal

- 1 Use black stick to disconnect fan cable.
- 2 Remove 3 screws:
  - 1 (7-mm) 922-8645
  - 2 (5-mm) 922-8644

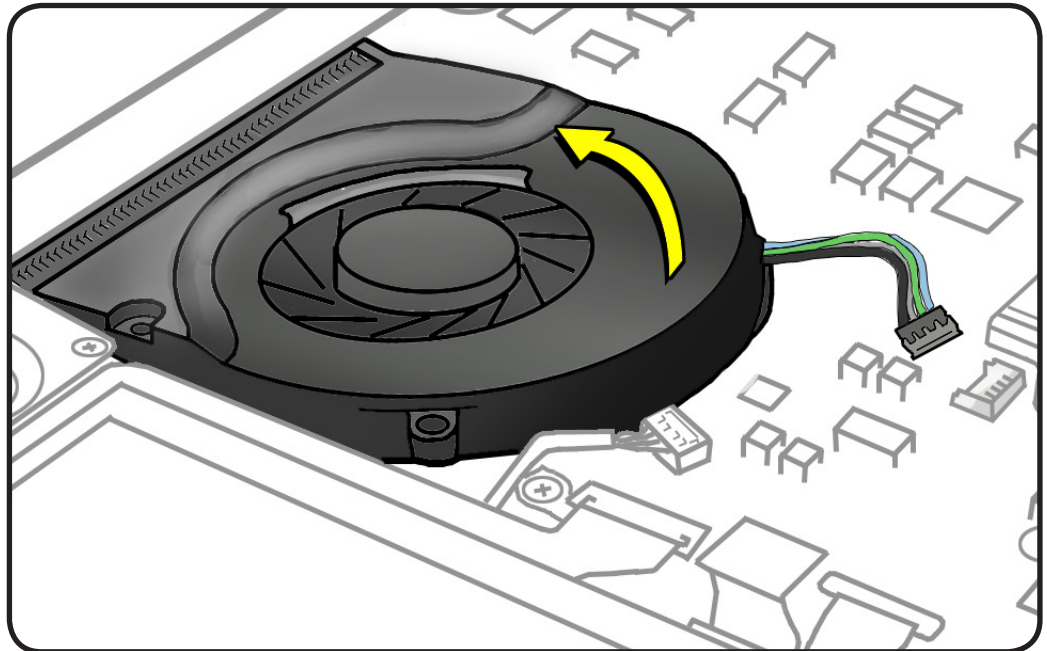


Caution: Do not touch heatsink:

**Replacement Note:** Install screws in order shown.



- 3 Tilt up fan.



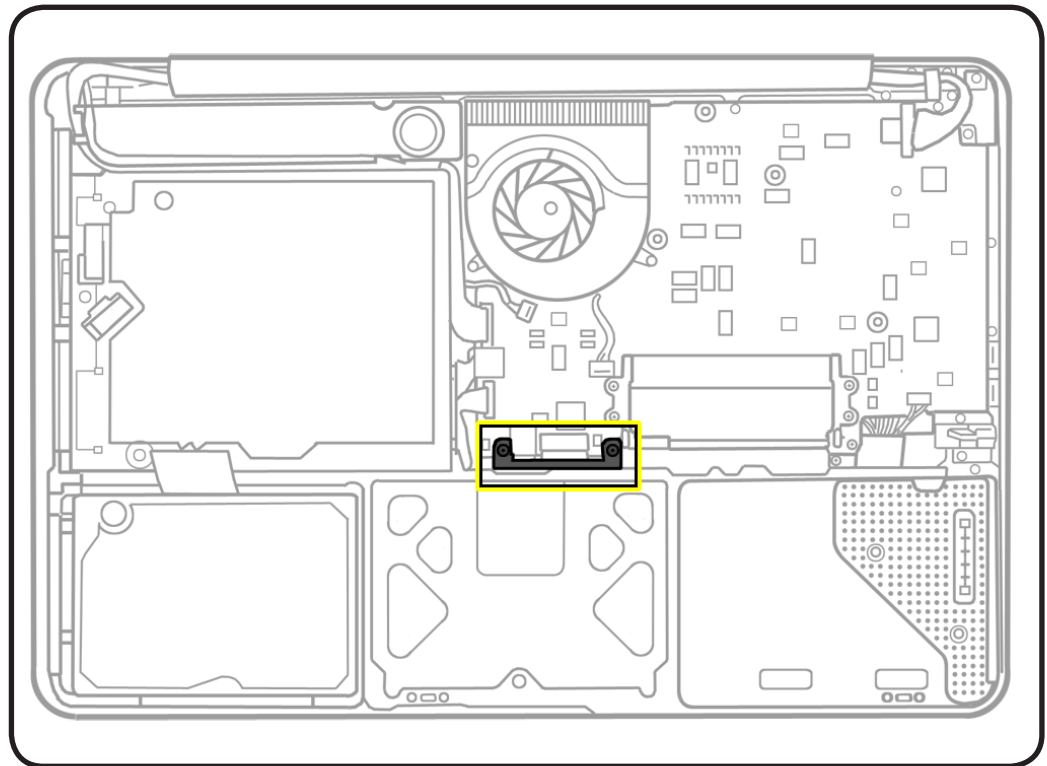


# Keyboard Flex Bracket

## First Steps

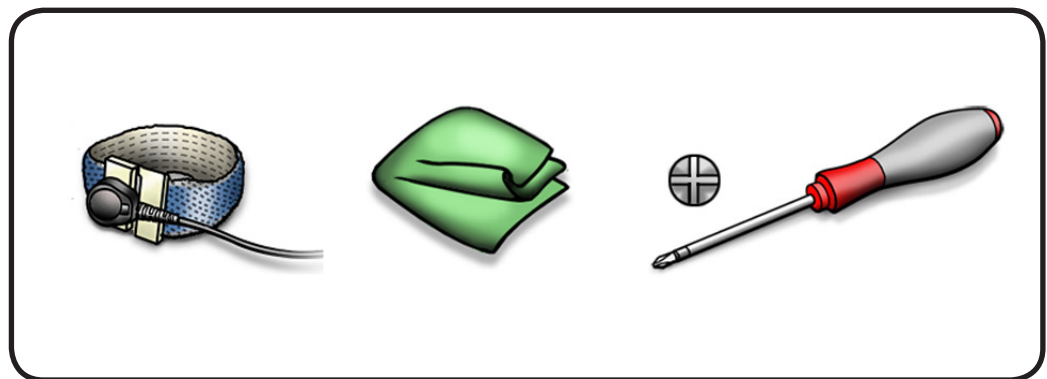
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)



## Tools

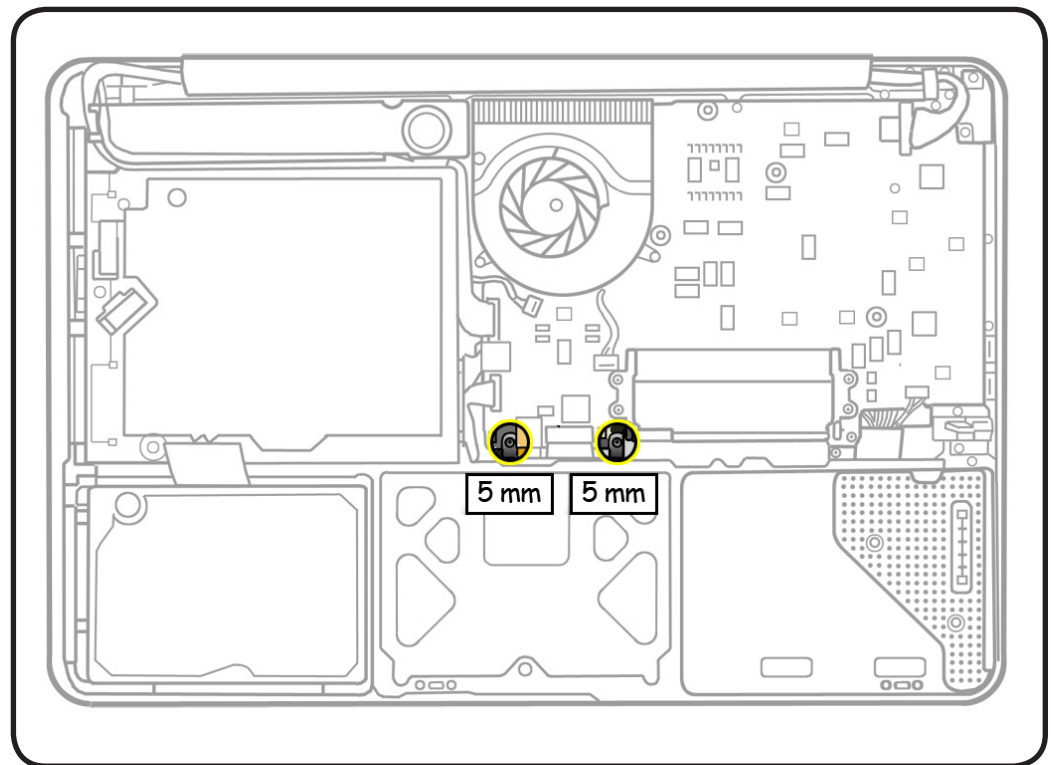
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver



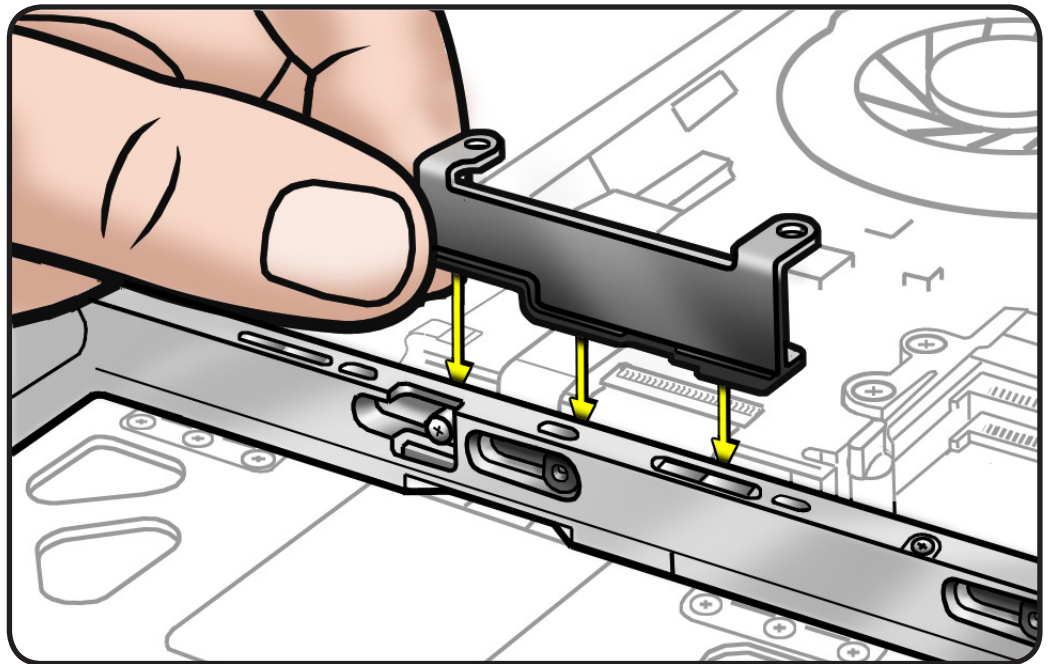


## Removal

- 1 Remove 2 (5-mm) 922-8644 screws.



- 2 Lift out bracket.





# Trackpad

## First Steps

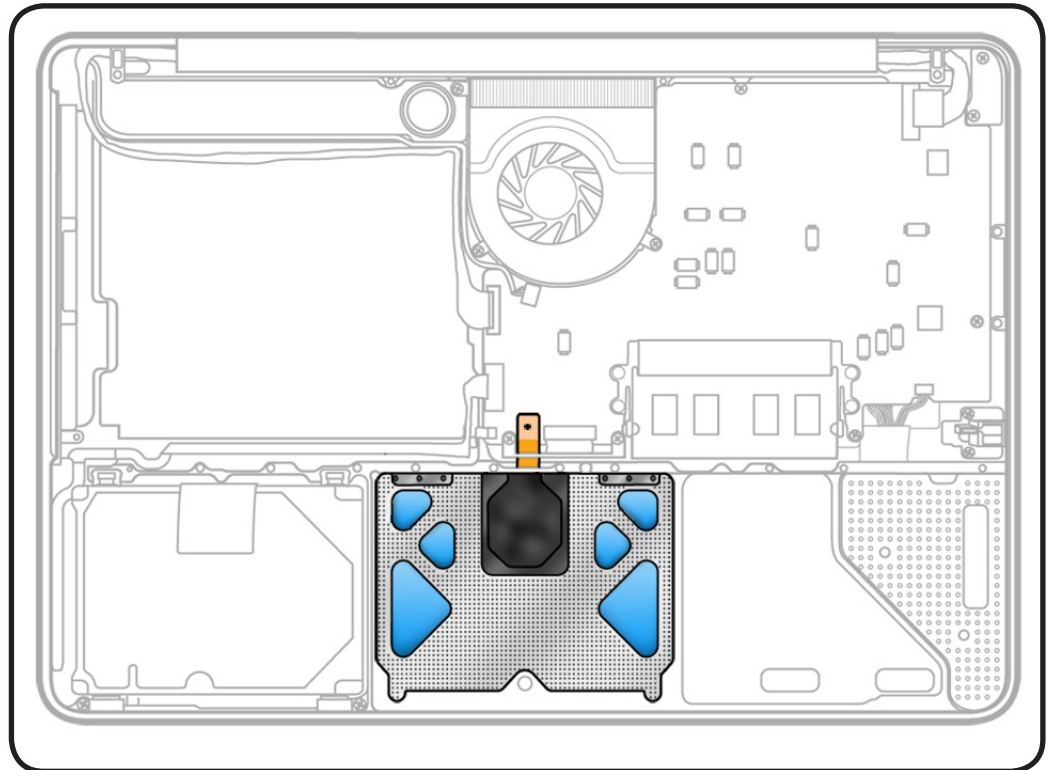
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Mid wall](#)
- [Keyboard flex bracket](#)

### Trackpad Kit 922-9014

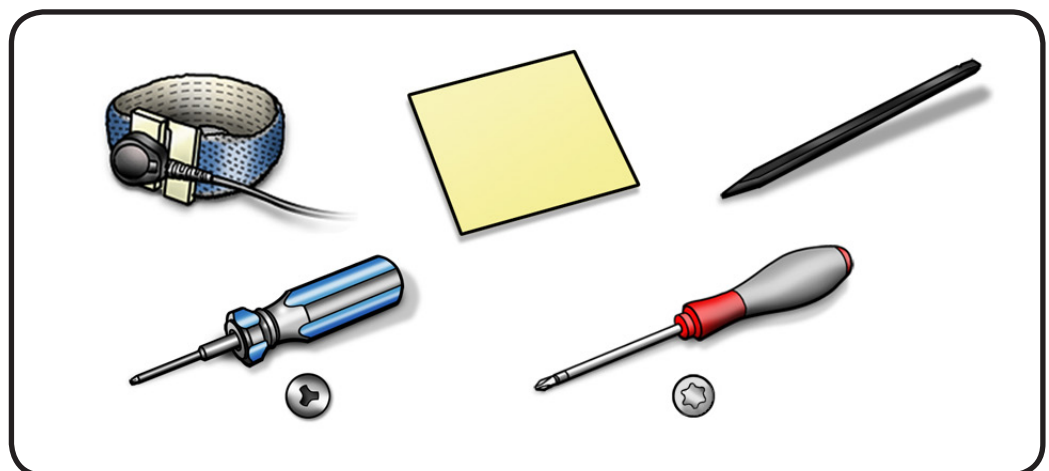
includes:

- trackpad
- black label
- 2 metal flexures
- 6 tri-lobe #00 screws
- 1 tri-lobe #0 set screw



## Tools

- ESD wrist strap and mat
- Sticky (Post-It) notes
- Black stick
- **Large** tri-lobe #0 screwdriver (922-8991)
- **Small** tri-lobe #00 screwdriver (922-9013)
- Magnetized Torx T5 screwdriver

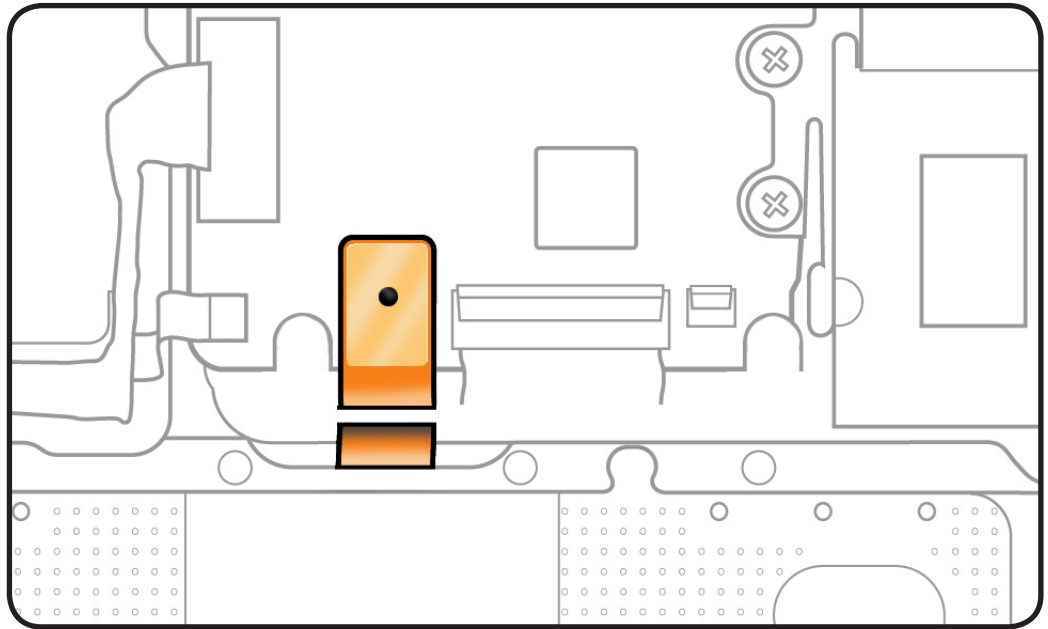




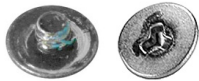


## Removal

- 1 Disconnect trackpad flex cable from logic board.



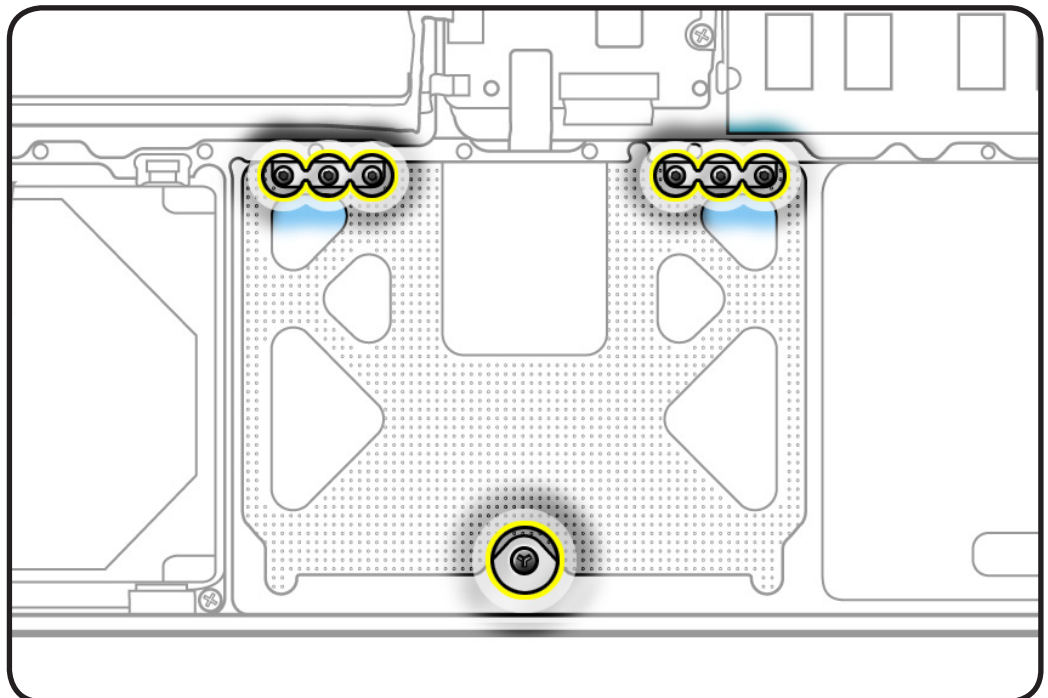
- 2 Remove 6 small tri-lobe #00 screws from flexures.



- 3 Remove 1 large tri-lobe #0 set screw.

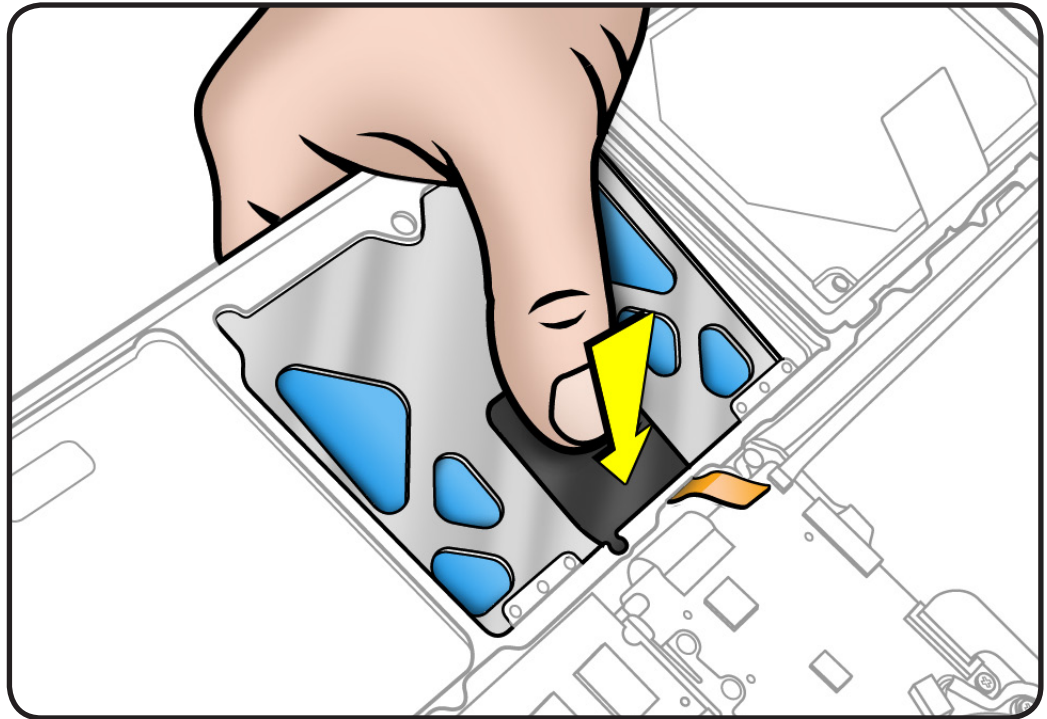


- 4 Dispose of old screws; they lose their ability to hold securely if reused.

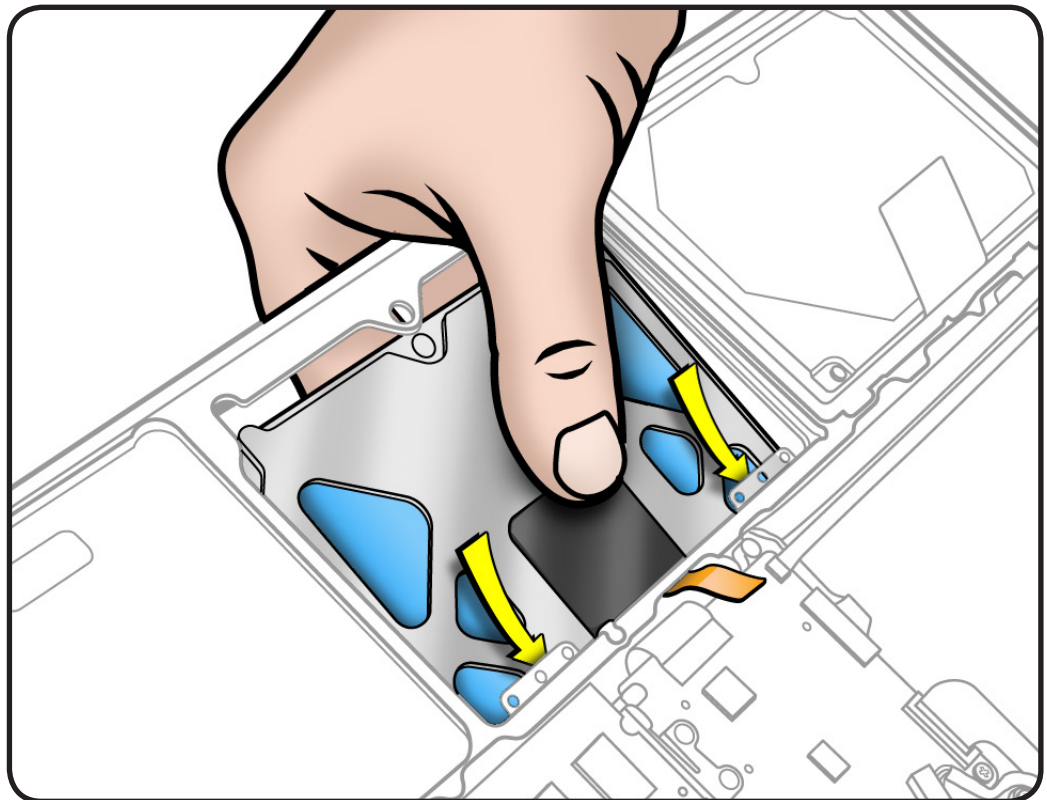




- 5** Hold trackpad and press down on edge closest to logic board.



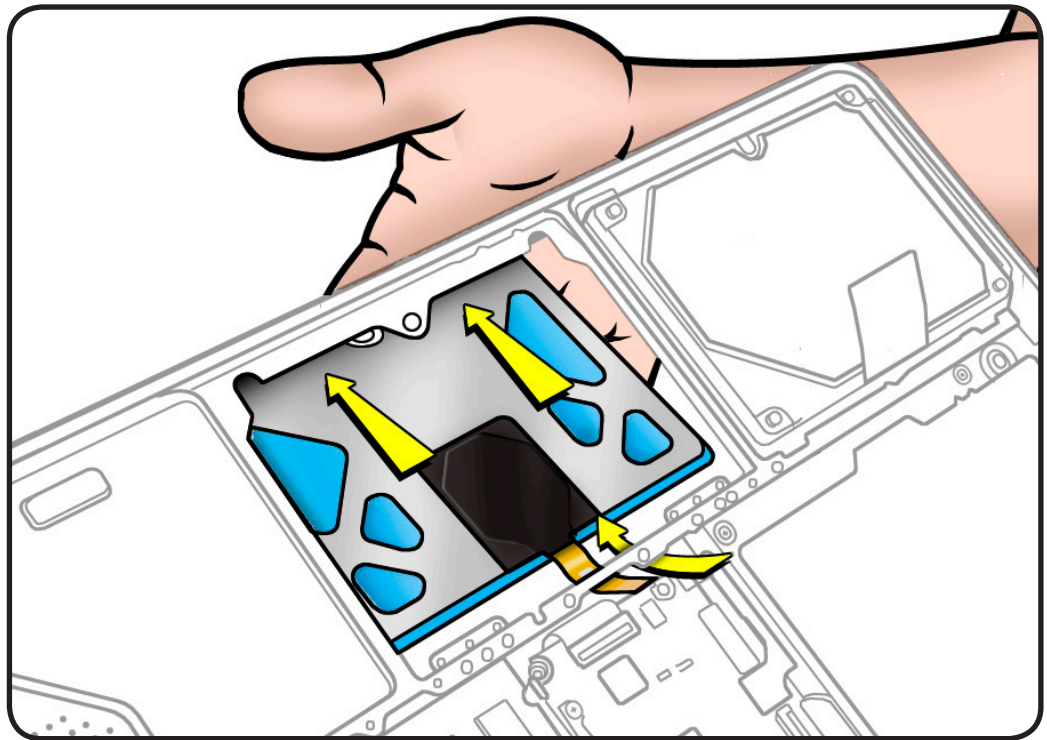
- 6** Slide trackpad down and back towards keyboard to clear supports in front edge of top case.







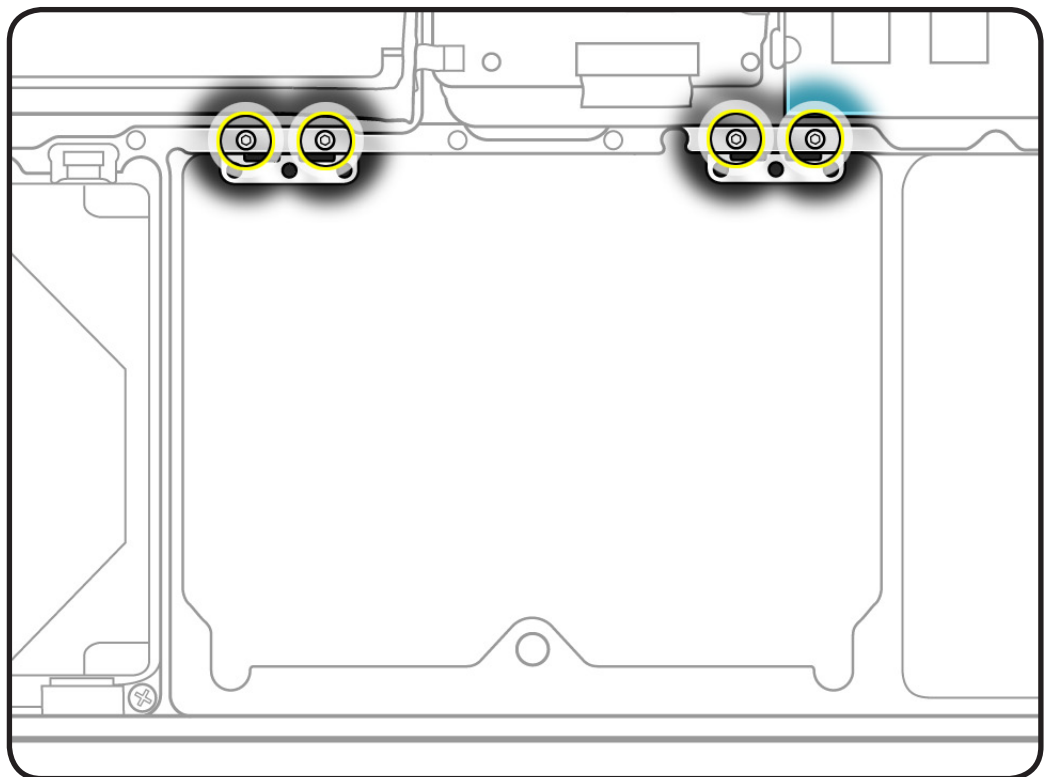
- 7** Remove trackpad from top case, taking care to route flex cable through hole.



- 8** Loosen 4 T5 screws. It is not necessary to remove these screws.

- 9** Remove 2 flexures (thin metal pieces) from top case.

- 10** Dispose of old flexures; they are matched to each individual trackpad by thickness.

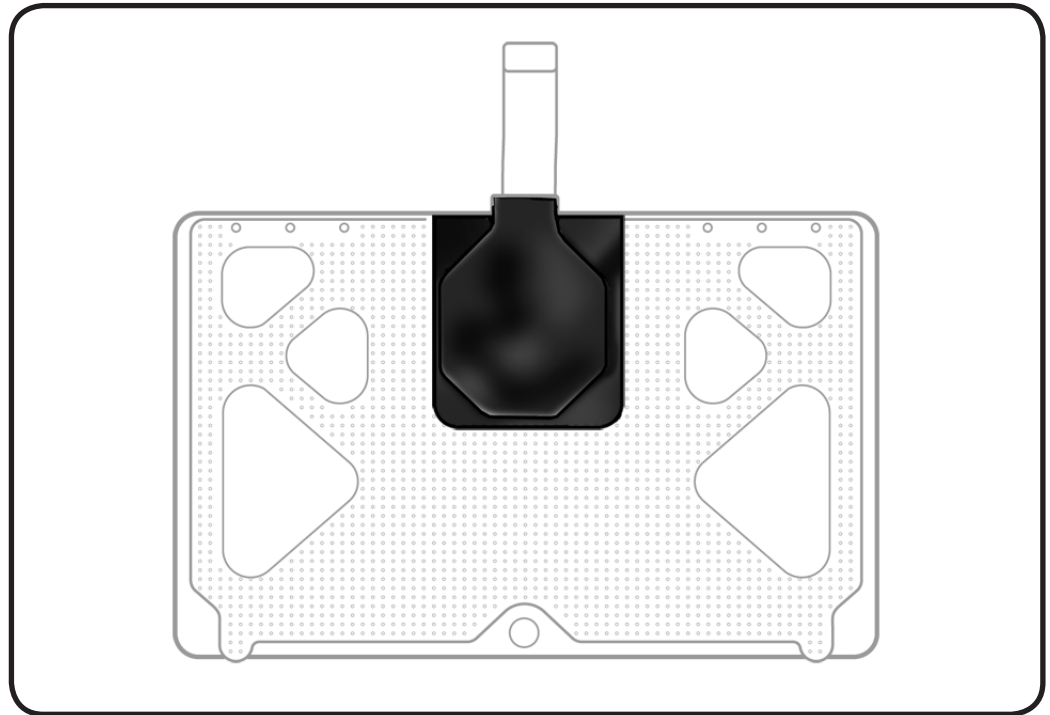




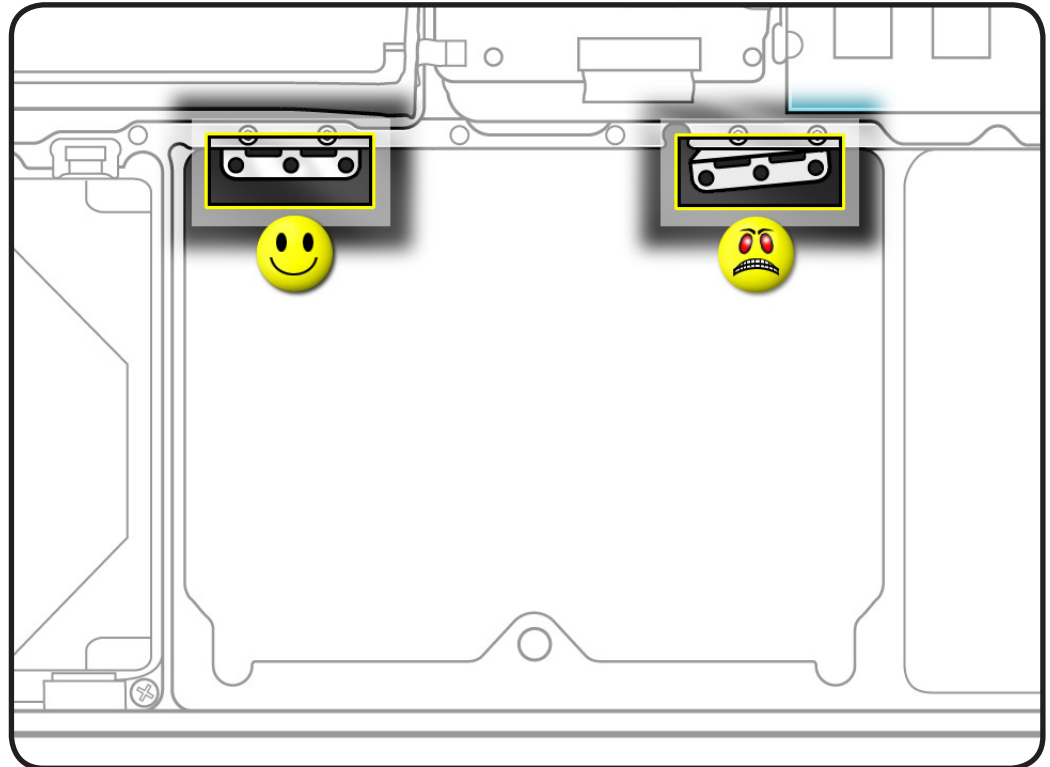
## Replacement

**Important:** Dispose of old flexures and tri-lobe screws, and only use new ones included with trackpad kit.

- 1 Peel and adhere black label (included with new trackpad) to cover trackpad stiffener as shown.

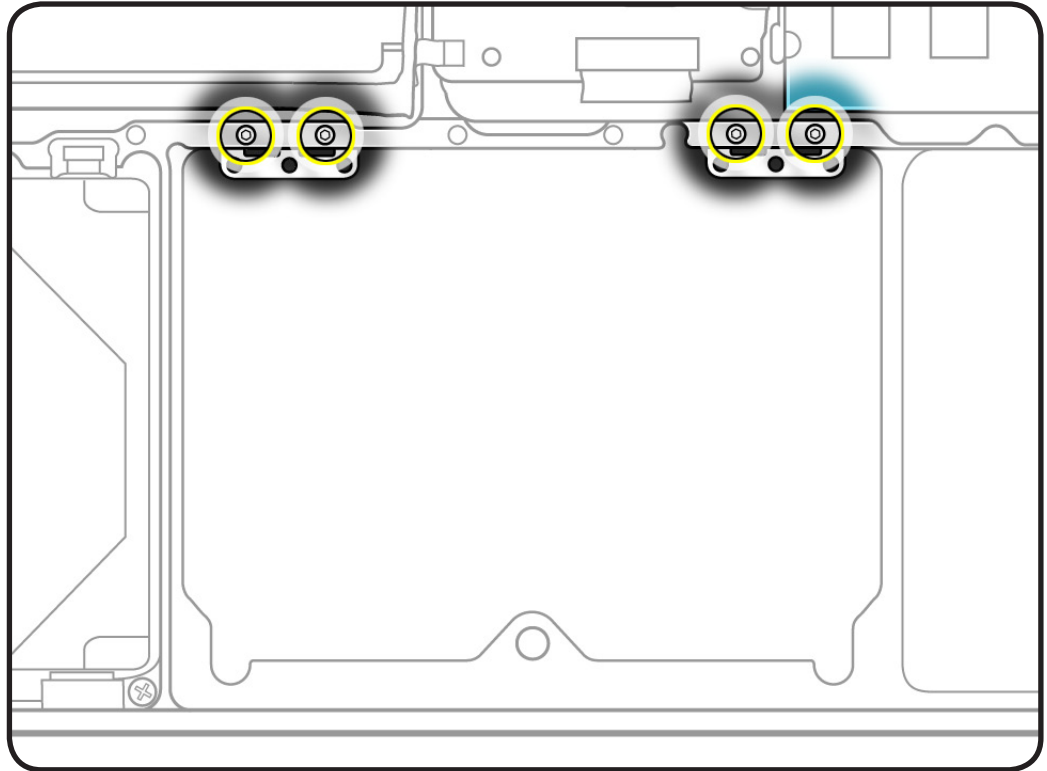


- 2 Insert flexures squarely into slots in top case.





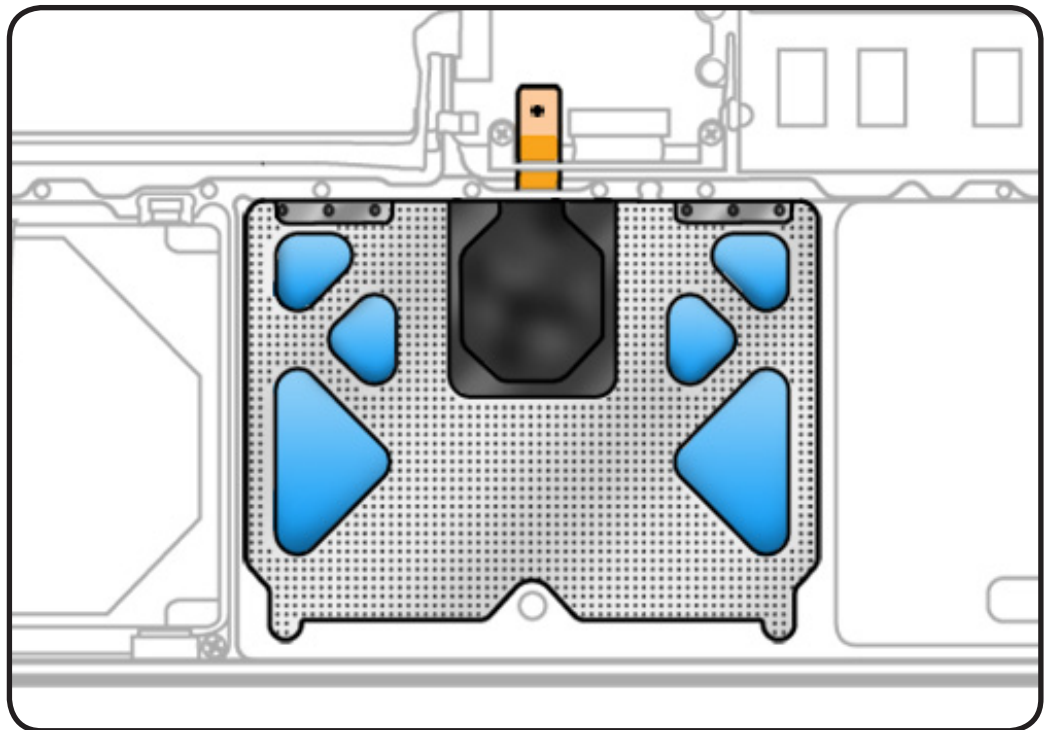
- 3 Tighten 4 T5 screws.



- 4 Carefully route flex cable through guidehole.

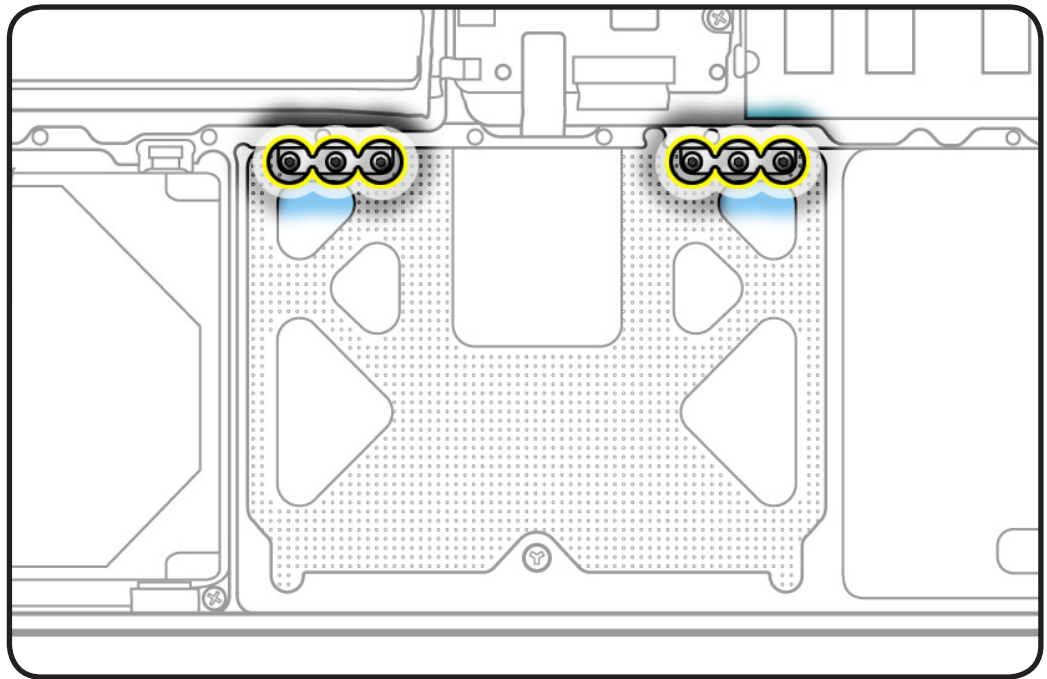
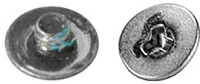
- 5 Pivot trackpad into place, inserting front edge first.

**Important:** Minimize rubbing edges of trackpad against top case while installing. This could cause invisible cracks to form in the glass of the trackpad.

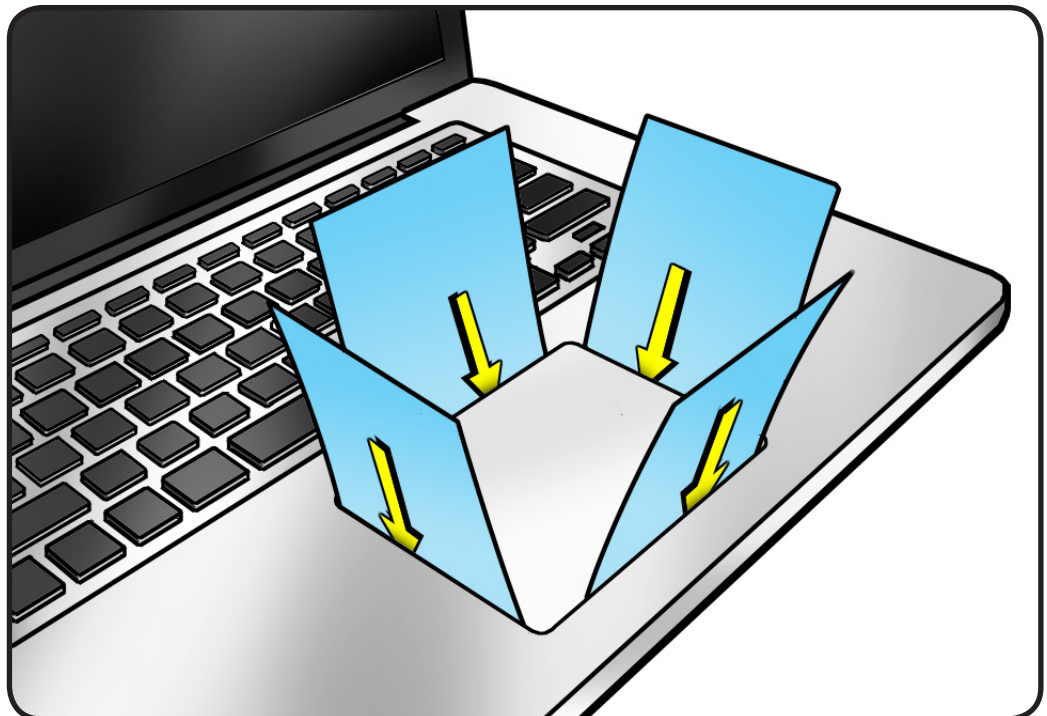




- 6** Loosely insert 6 small tri-lobe #00 screws into flexures. Do not tighten yet.

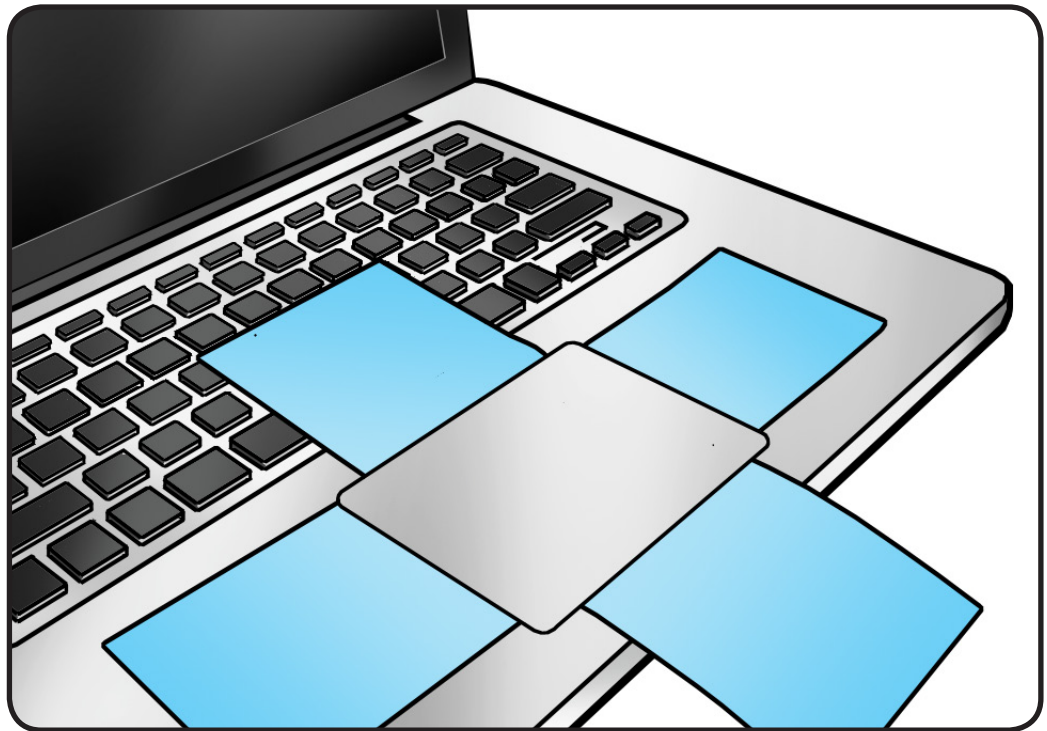


- 7** On the palm rest, insert one sticky (Post-It) note into gap on each of the four sides of trackpad.

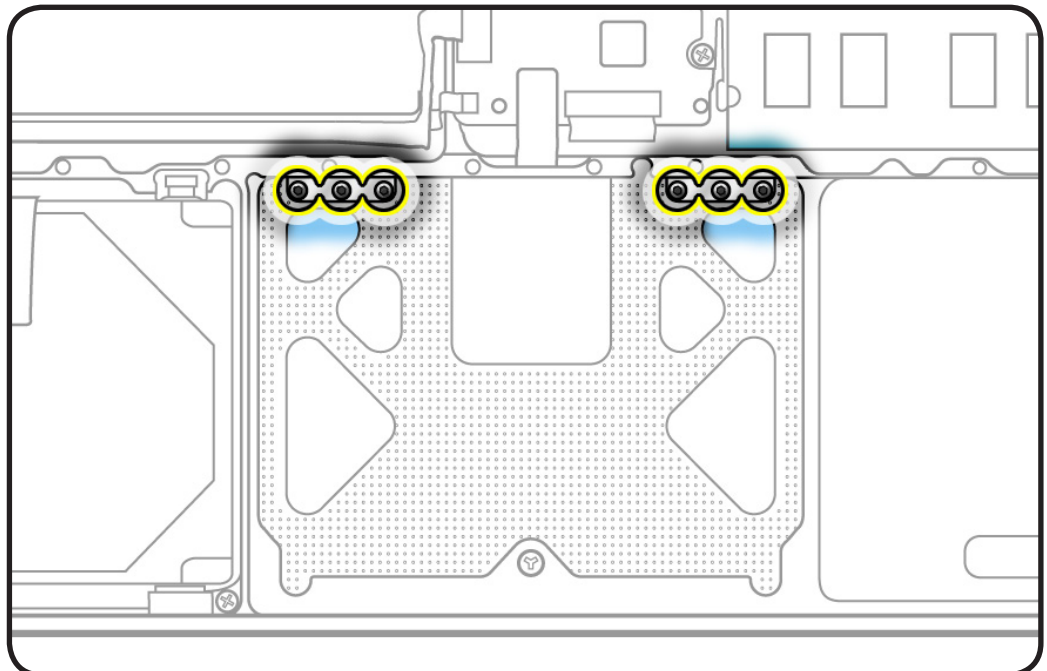




- 8** Fold sticky notes over so that top case can be laid flat.



- 9** Tighten 6 small tri-lobe #00 screws at flexures.
- 10** Inspect that gaps between trackpad and top case are even on all sides. If not, loosen screws and adjust.





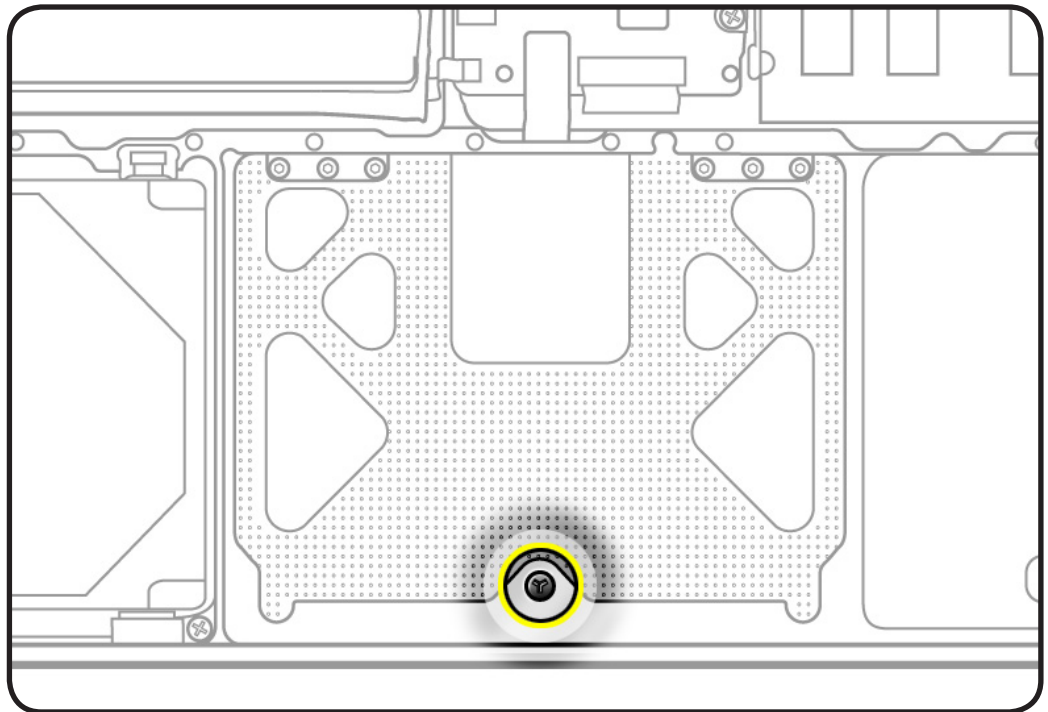


- 11** Insert large tri-lobe #0 set screw.

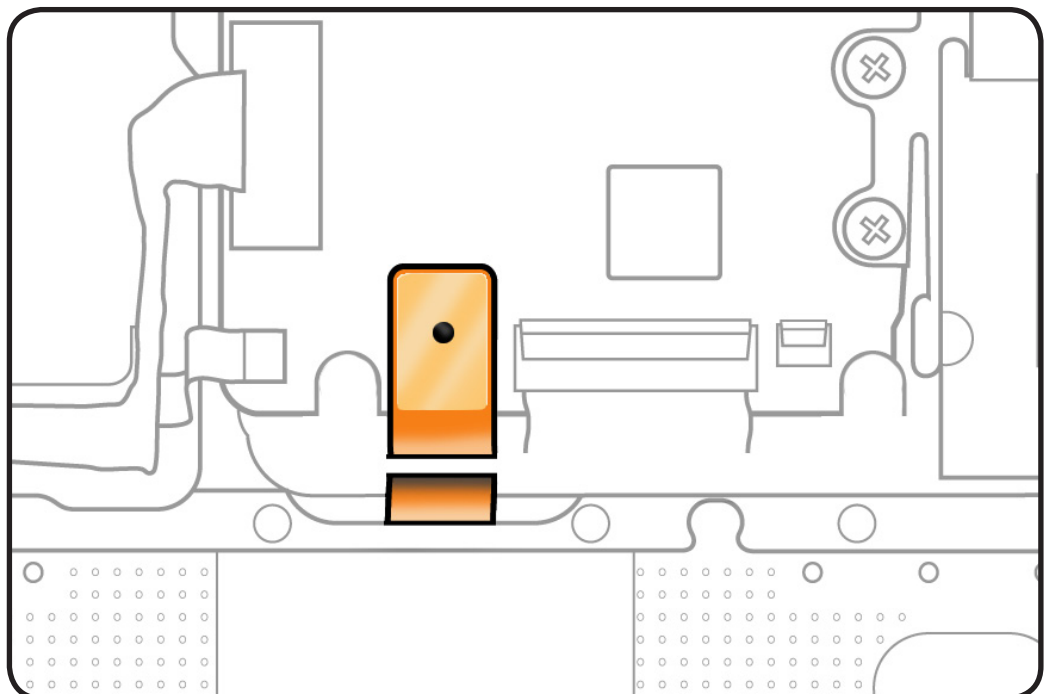


- 12** Slowly turn set screw in small increments until trackpad has a normal clicking motion.

**Important:** Do not overtighten set screw or you may damage trackpad.



- 13** Connect flex cable to logic board.



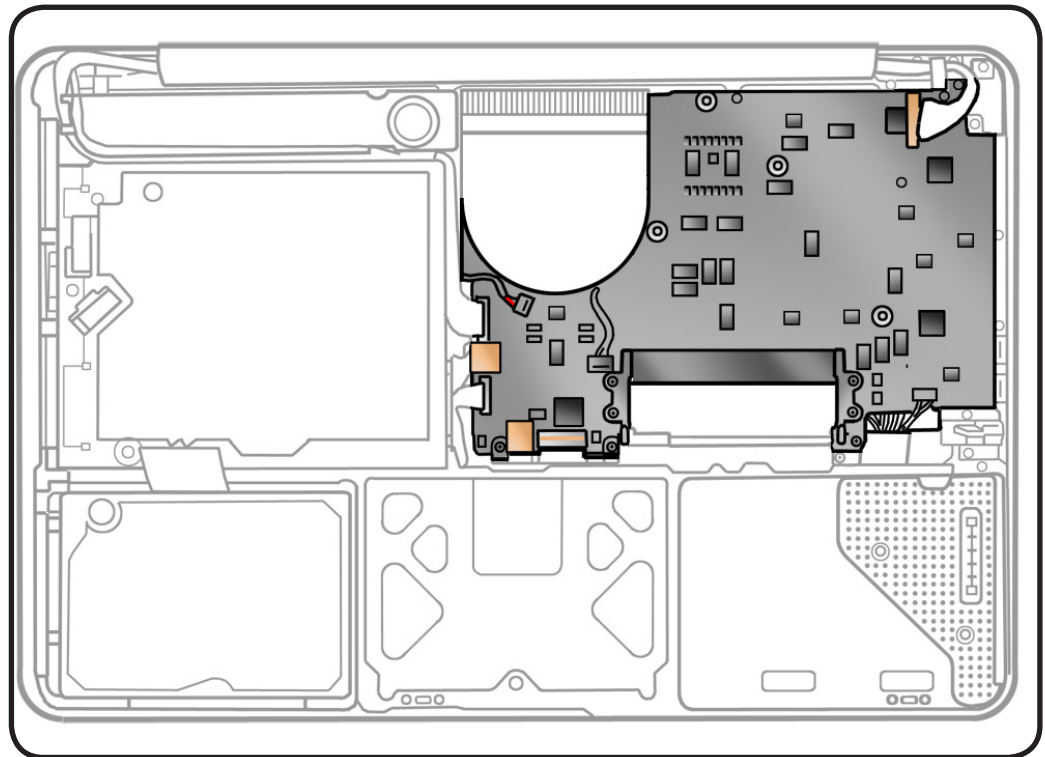


# Logic Board

## First Steps

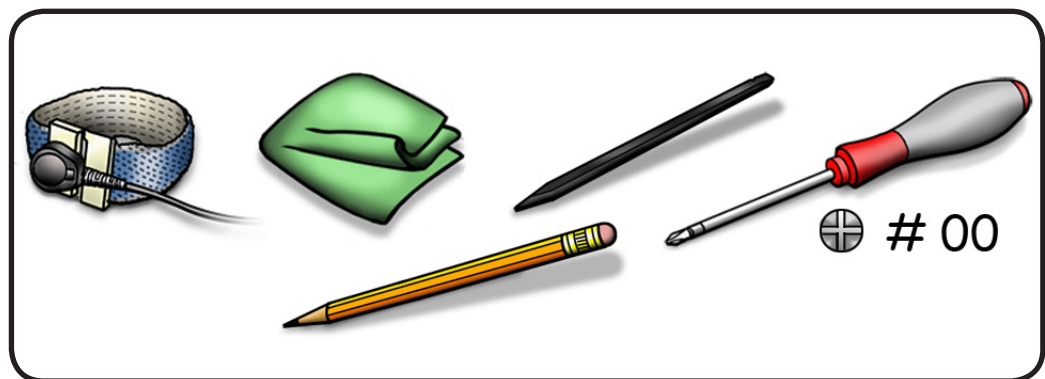
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Memory](#)
- [Fan](#)
- [Keyboard flex bracket](#)



## Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
- Tweezers (optional)
- Pencil with eraser
- Black stick





## Removal



**Caution:** Do not touch heatsink or gold connectors:

**Caution:** Refer to [Connector Types](#) before disconnecting cables.

- 1 Disconnect 9 cables:
  - 2 locking lever
  - 2 platform flex
  - 2 low-profile horizontal
  - 3 vertical insert

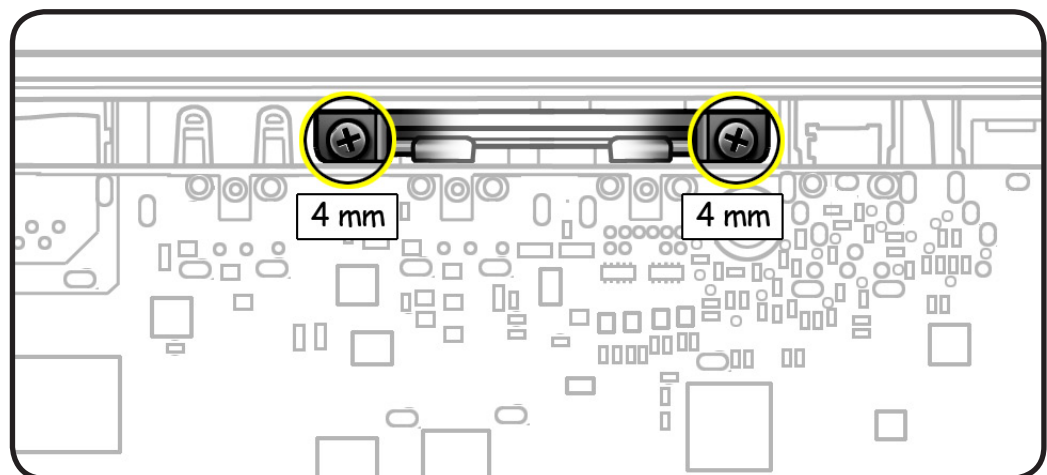
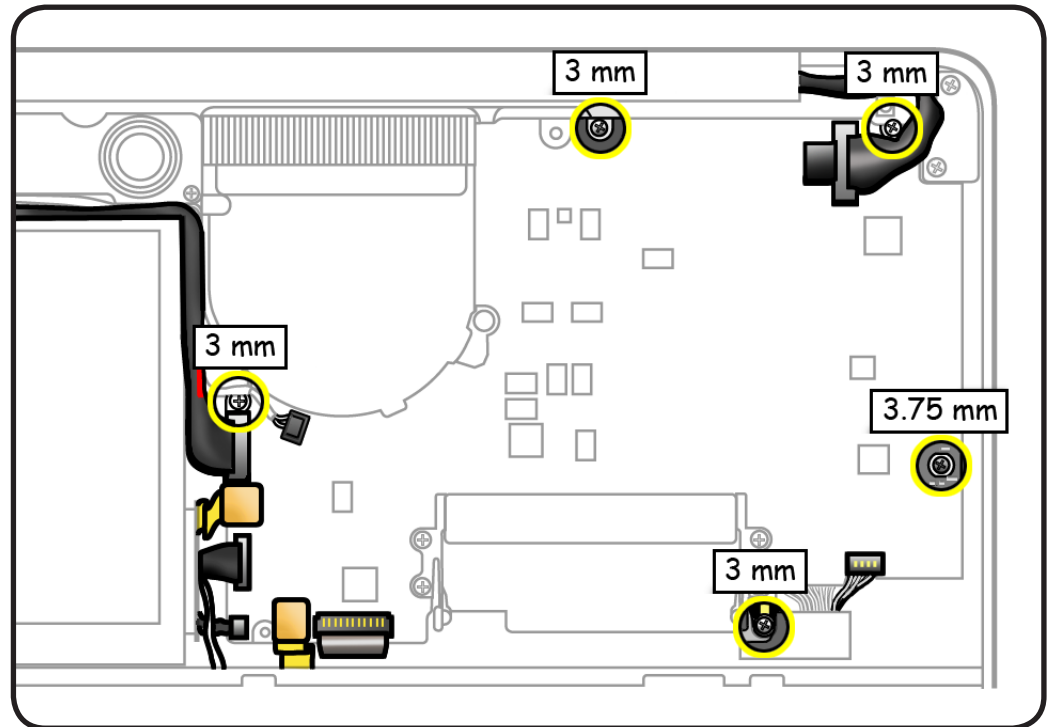
**Note:** You may use two plastic tweezers to remove and reinstall the locking lever flex cables.

- 2 Remove 5 screws:
  - 1 (3.75-mm) 922-8654
  - 4 (3-mm) 922-8663

**Note:** Do not remove or loosen 2 MagSafe board screws.

- 3 Remove 2 (4-mm) 922-8753 screws at port side for bottom case clip.

- 4 Remove bottom case clip.



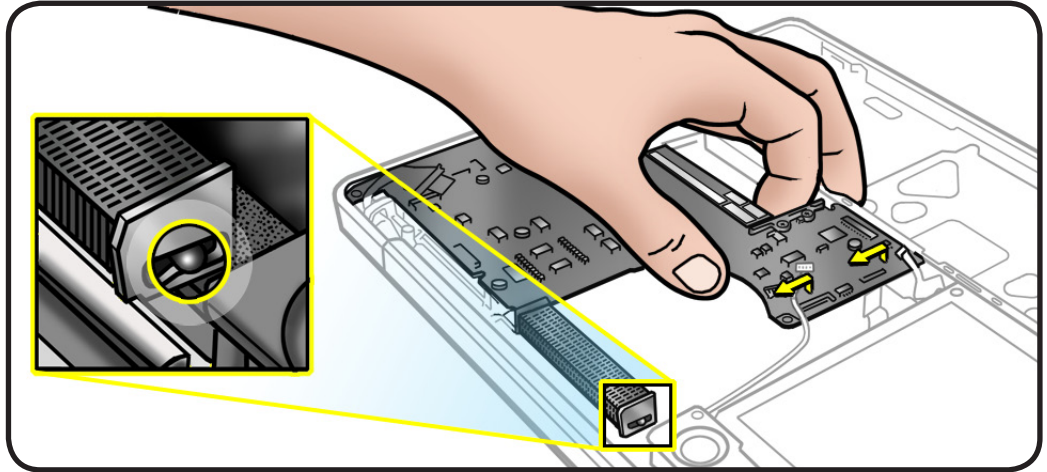




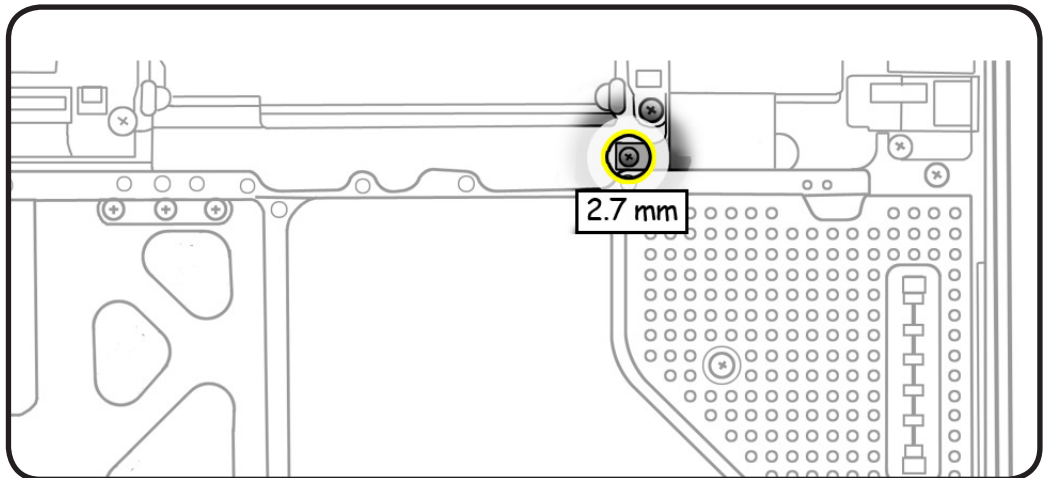
- 5** Caution: Make sure cables are not pinched.



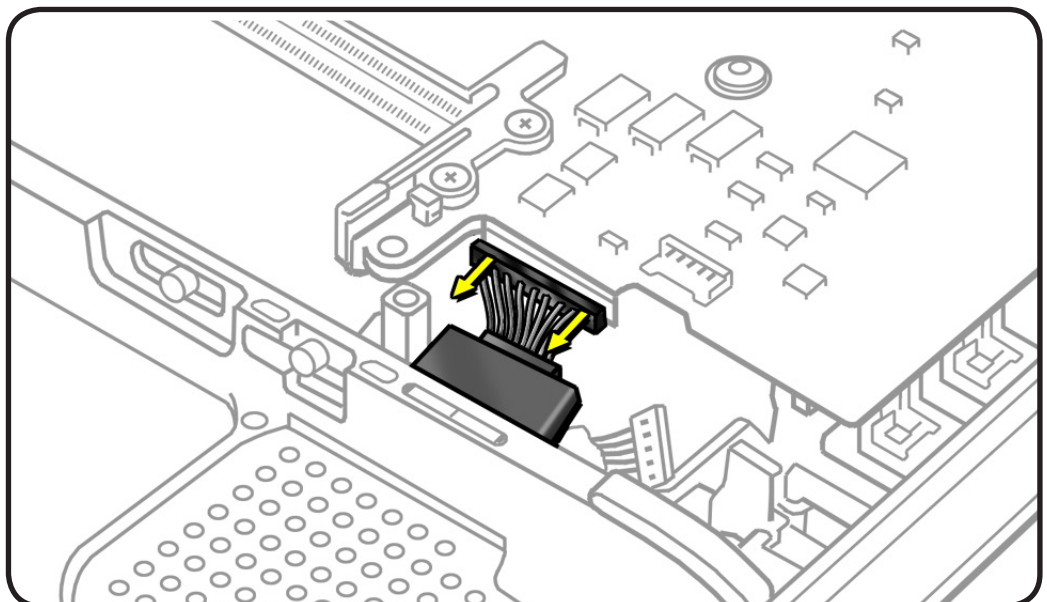
- 6** Pivot logic board to free locking pin.



- 7** Remove 2.7-mm screw (922-8661) and battery cable guide to disconnect battery connector.



- 8** Disconnect battery connector from underside of logic board.





**9** Tilt board vertically and locate

- microphone cable
- MagSafe cable

**10** Disconnect cables and unroute microphone cable from speaker.



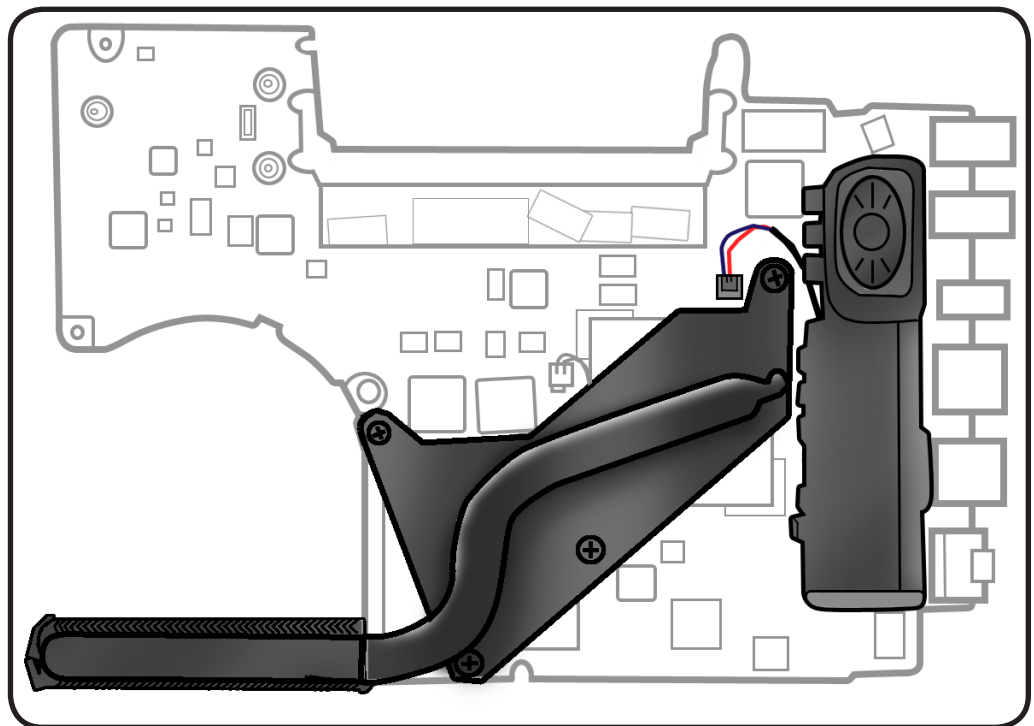
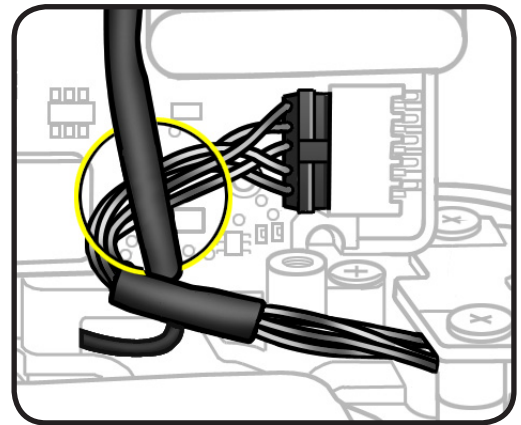
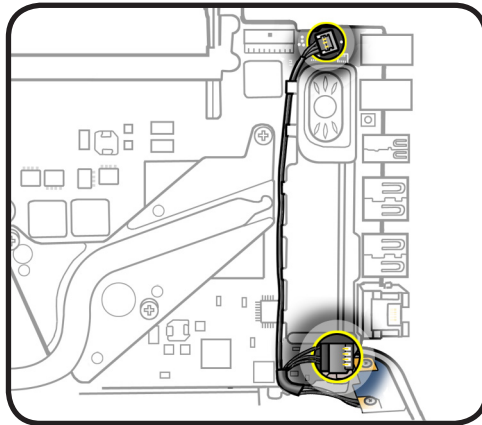
**Caution:** Be careful not to strain or pinch the microphone cable.

**Replacement Note:** Make sure cables are routed as shown..

**11** Do not remove the speaker and heatsink if reinstalling the same logic board.

**12** If replacing the logic board with a new one, transfer

- [Left speaker](#)
- [Heatsink](#)

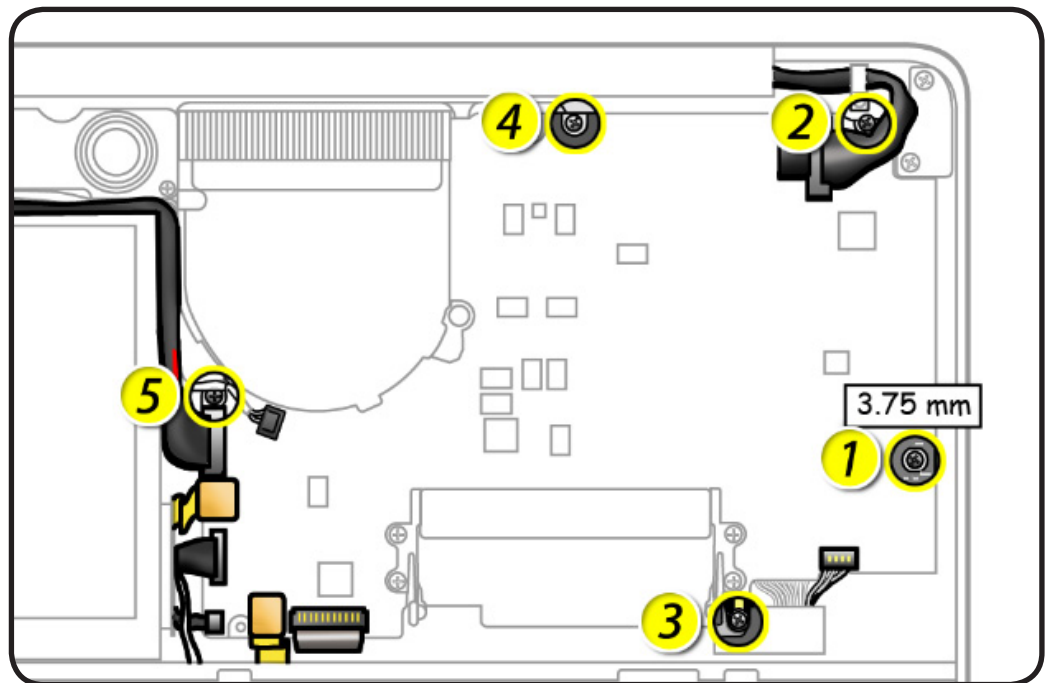




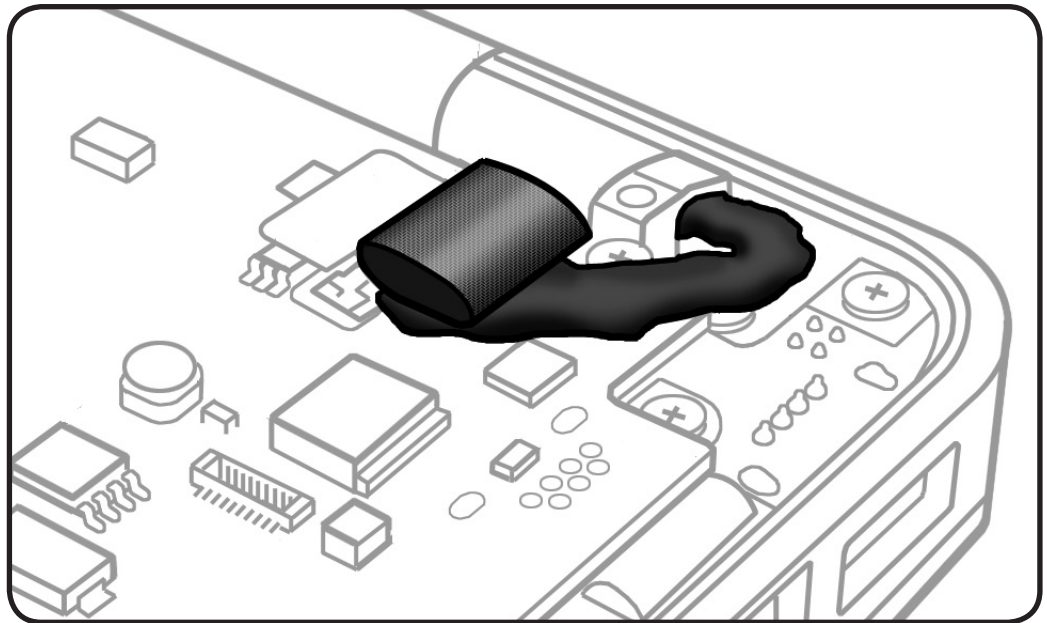
## Replacement

**Caution:** Refer to [Connector Types](#) when connecting cables.

- 1** From underside of board, make sure to connect:
  - left speaker
  - heatsink
  - microphone cable
  - MagSafe cable
- 2** When tilting board into top case, keep cables away.
- 3** Install bottom case clip.
- 4** Install 5 screws in order shown.

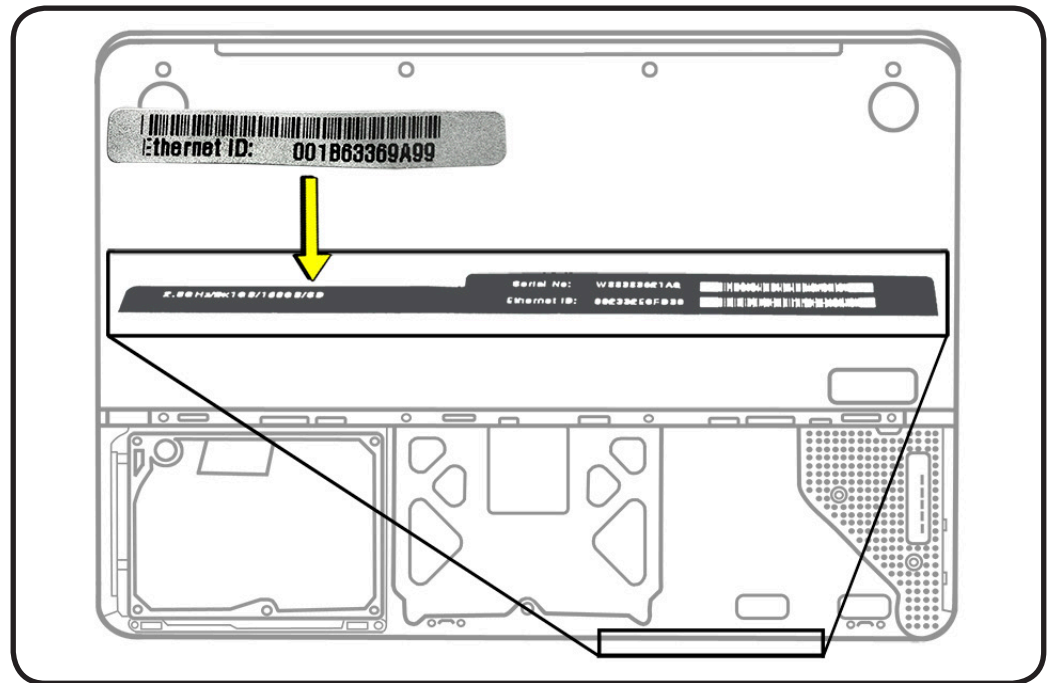


**Replacement Caution:**  
To prevent video “noise,” a whining sound, no video, or a short to the logic board, be sure to place foam gasket on LVDS connector—**positioned precisely where shown**—**after** cable is fully connected to logic board.





**Important:** New logic boards include a loose Ethernet ID label. When replacing the logic board with a new one, place the label on the inside front wall of the top case, and use a permanent-ink pen to strike out the old Ethernet ID number.



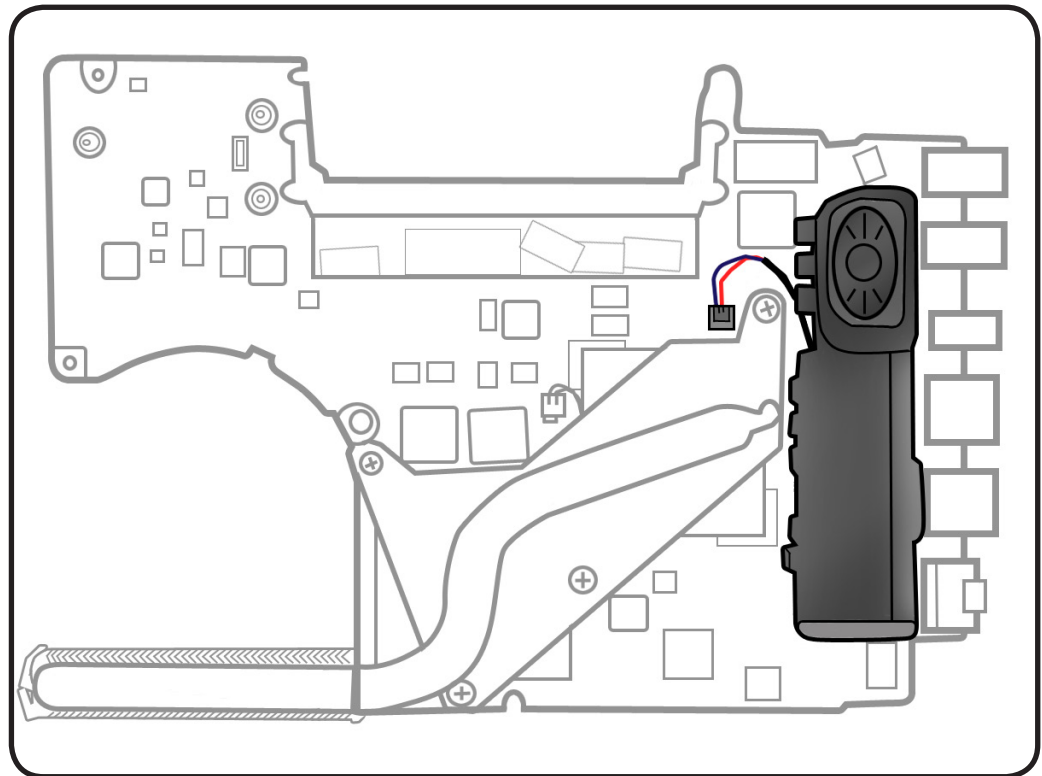


# Left Speaker

## First Steps

Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Memory](#)
- [Fan](#)
- [Keyboard flex bracket](#)
- [Logic board](#)



## Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Black stick



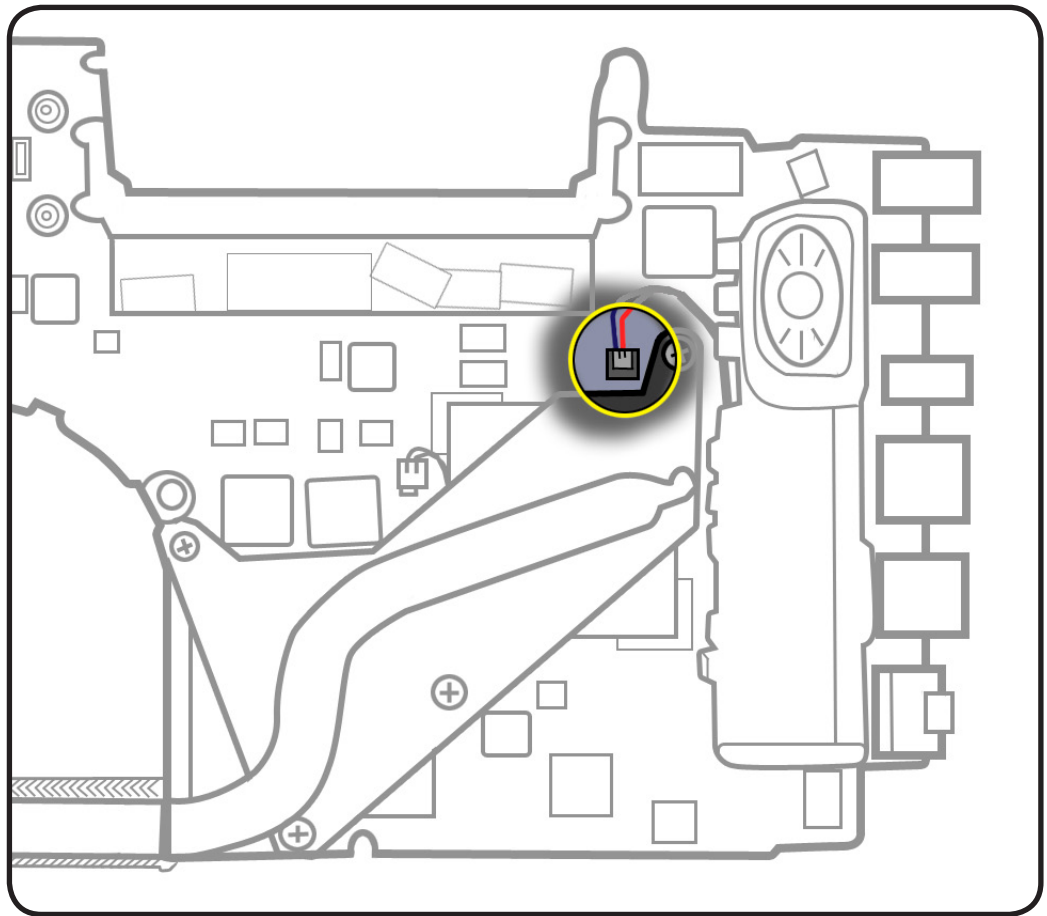


## Removal

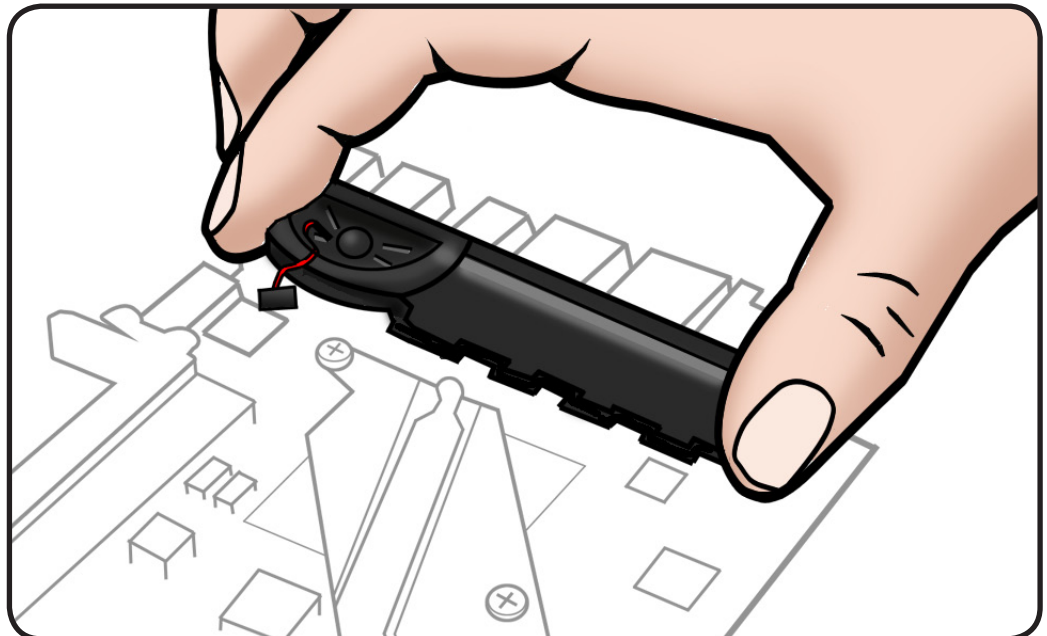


Caution: Do not touch heatsink or gold connectors:

- 1 Disconnect the speaker connector.
- 2 Caution: Do not touch the soft speaker cone.



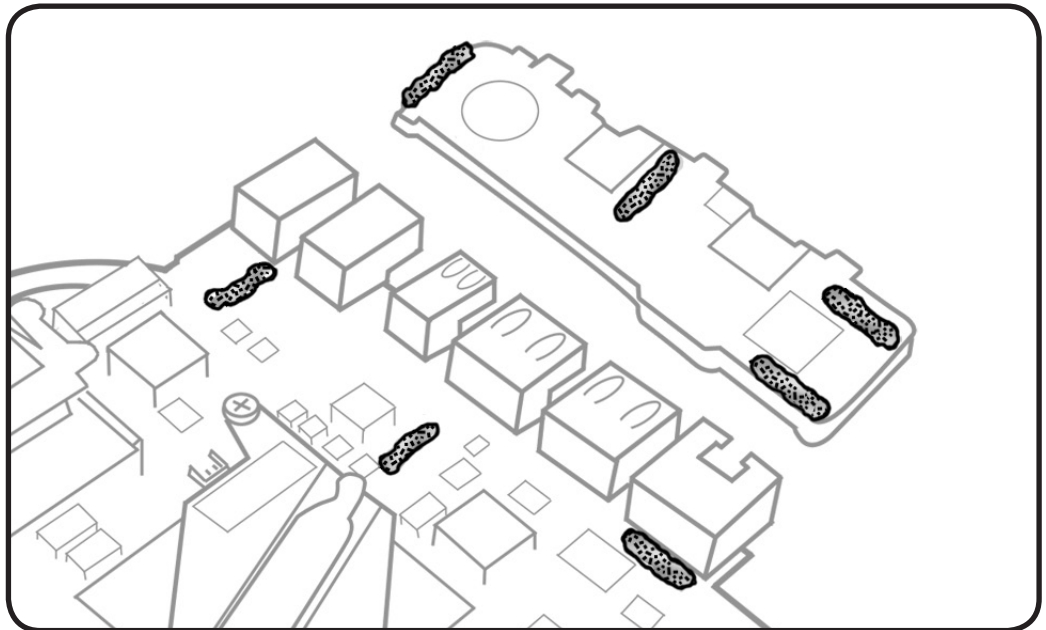
- 3 Remove speaker body.







- 4** Notice the foam pad remnants on
- speaker body
  - logic board

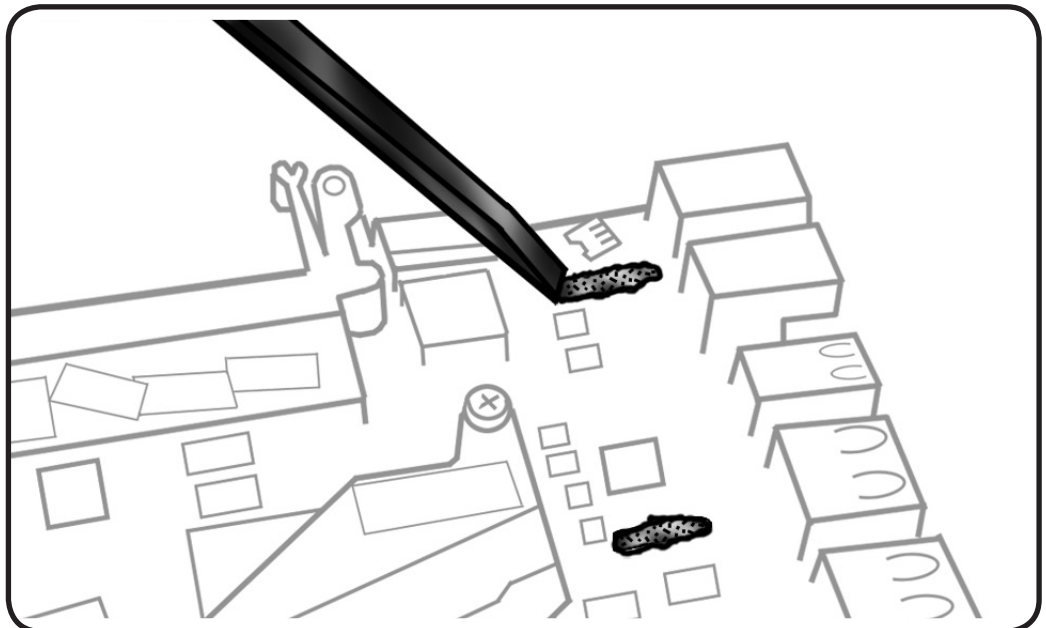


- 5** Carefully scrape away remnants before installing new speaker.



## Replacement

- 1** Make sure left speaker body and logic board are free of
- dust
  - scratches
  - plastic burrs



- 2** Connect speaker cable to logic board.
- 3** Remove paper backing from four foam pads, and press speaker onto port side of logic board.

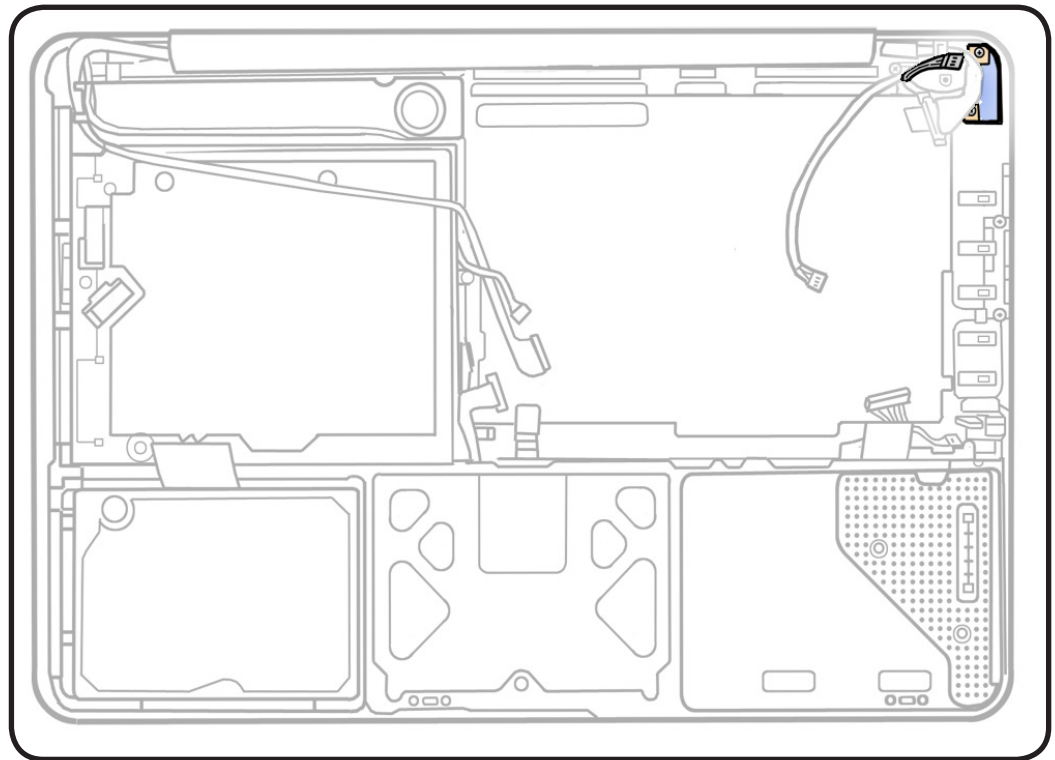


# MagSafe Board

## First Steps

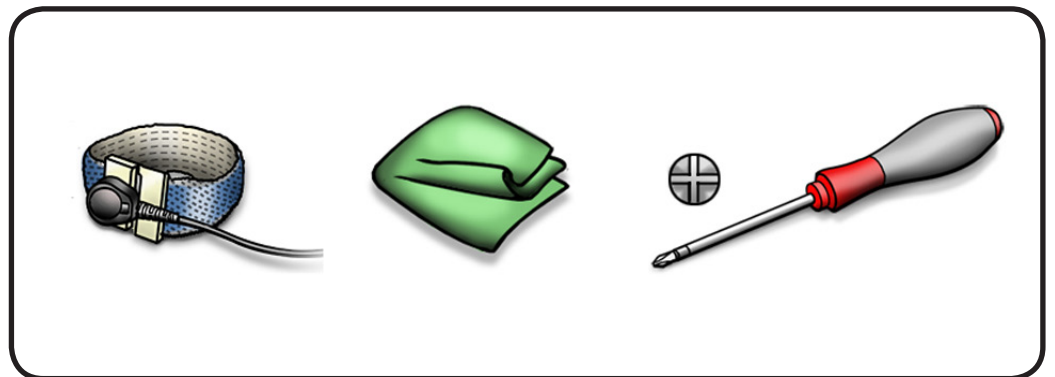
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Memory](#)
- [Fan](#)
- [Keyboard flex bracket](#)
- [Logic board](#)



## Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver

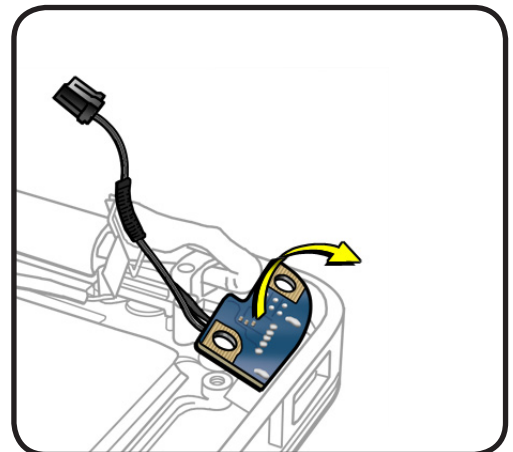
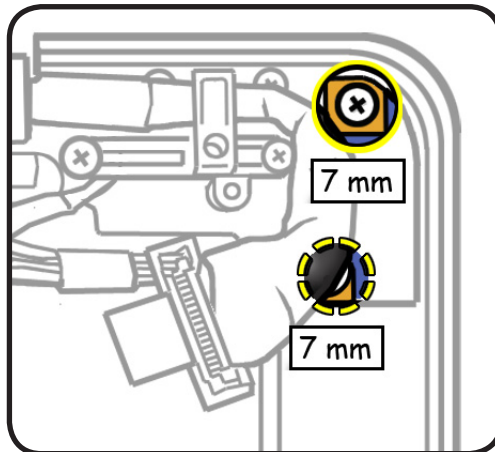






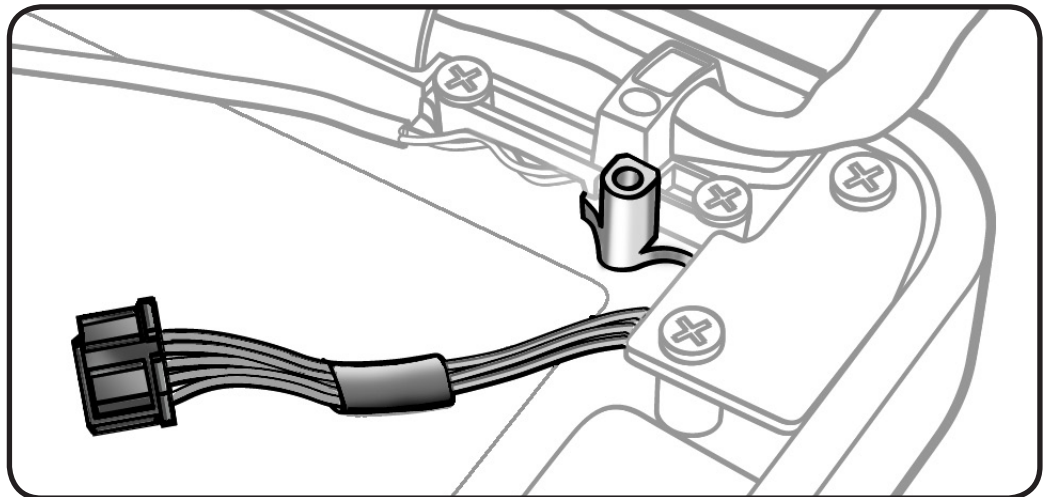
## Removal

- 1 Remove 2 (7-mm) 922-8645 screws.
- 2 Tilt out MagSafe board.



## Replacement

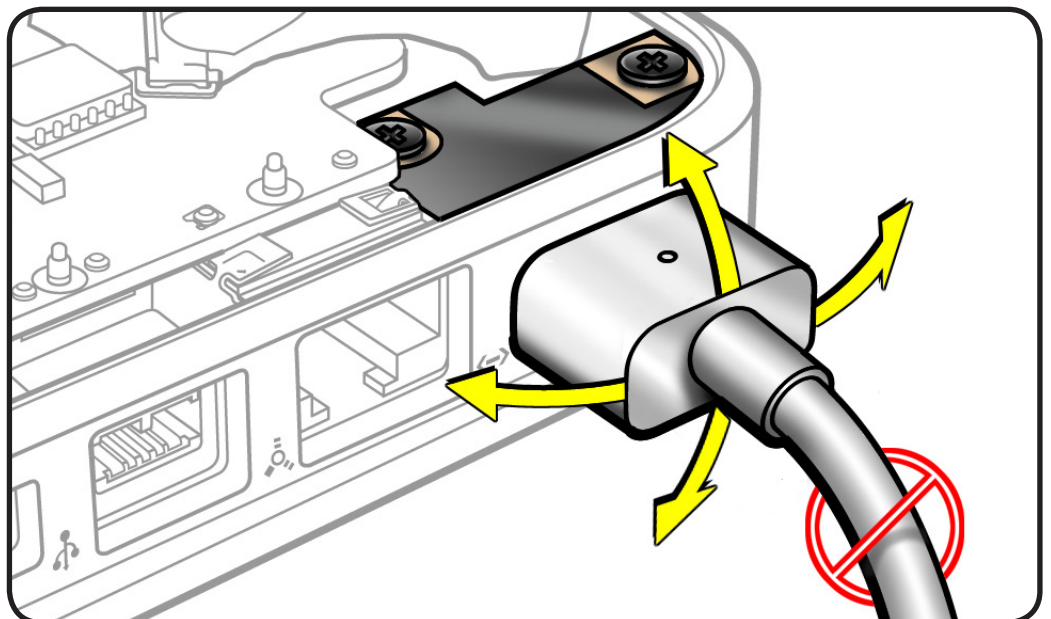
- 1 Make sure MagSafe cable is routed away from screw standoff, as shown.



- 2 **Important:** Connect unplugged external power adapter cable to MagSafe port to make sure port stays completely aligned in top case.

- 3 Install screws to MagSafe board before installing logic board.

- 4 With computer fully assembled, test power with power cable.



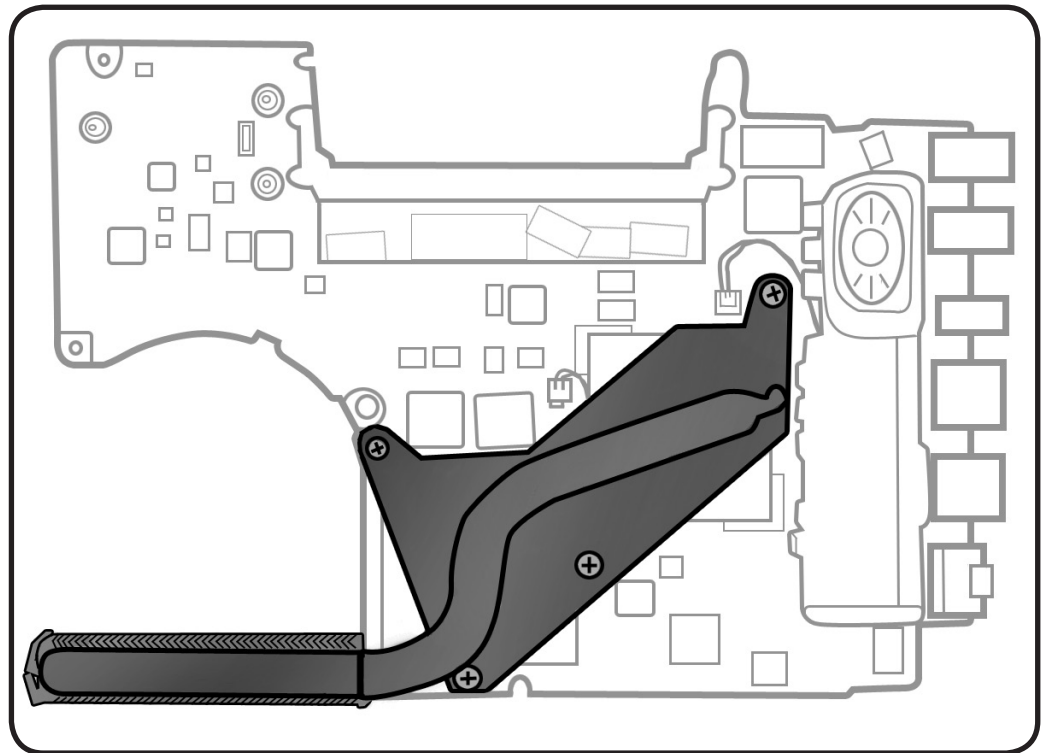


# Heatsink

## First Steps

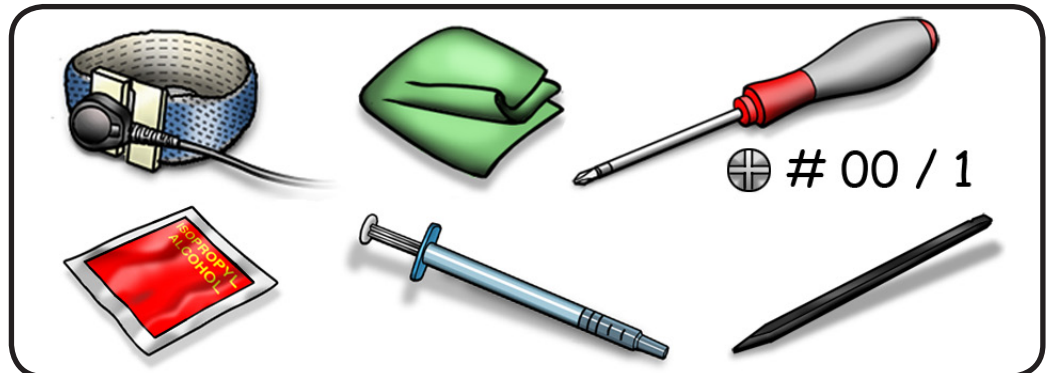
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Memory](#)
- [Fan](#)
- [Keyboard flex bracket](#)
- [Logic board](#)



## Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #0 or #1 screwdriver
- Thermal grease syringe
- Alcohol pads
- Black stick





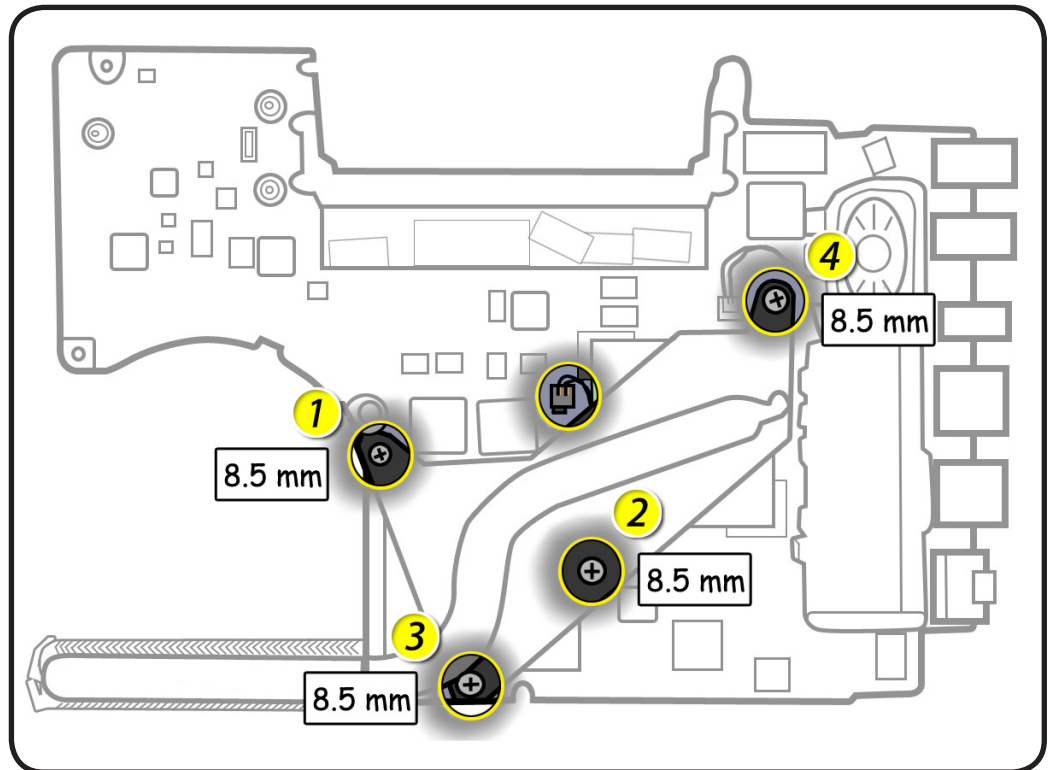
## Removal



Caution: Do not grasp heatsink arm:

- 1 Disconnect thermal sensor.
- 2 Remove 4 (8.5-mm) 922-8692 screws in order shown.

**Replacement Note:** Install heatsink screws 1/2 way first; then tighten in order shown.

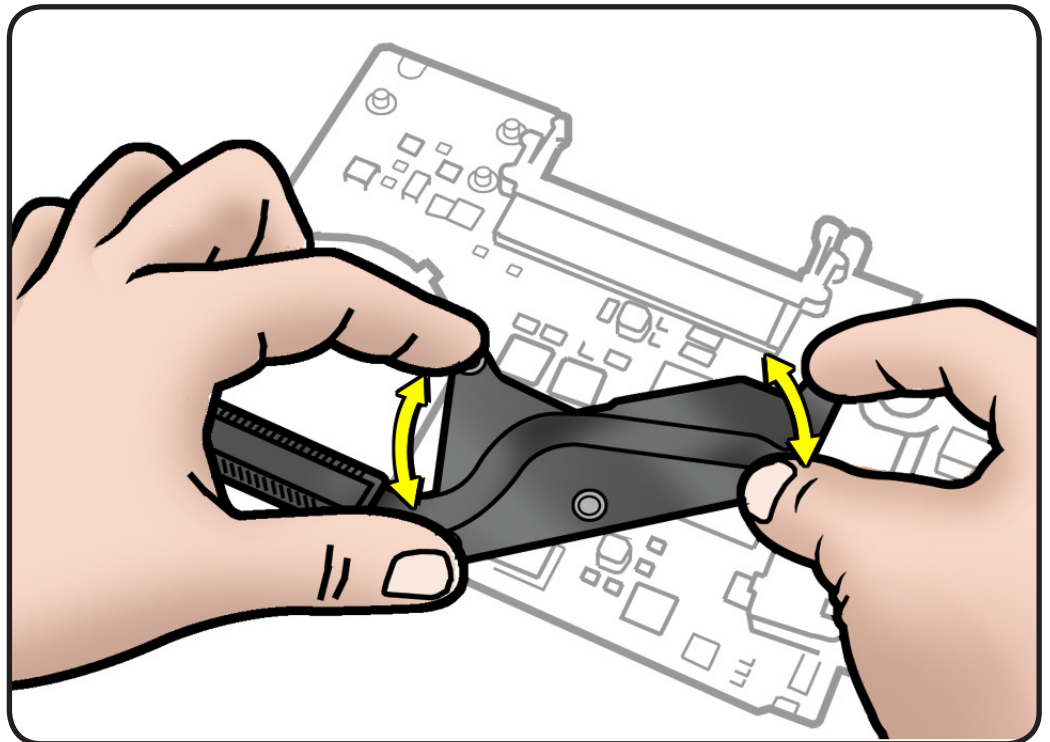


- 3 Keeping heatsink parallel to logic board, gently wiggle heatsink to loosen the bond to the board.



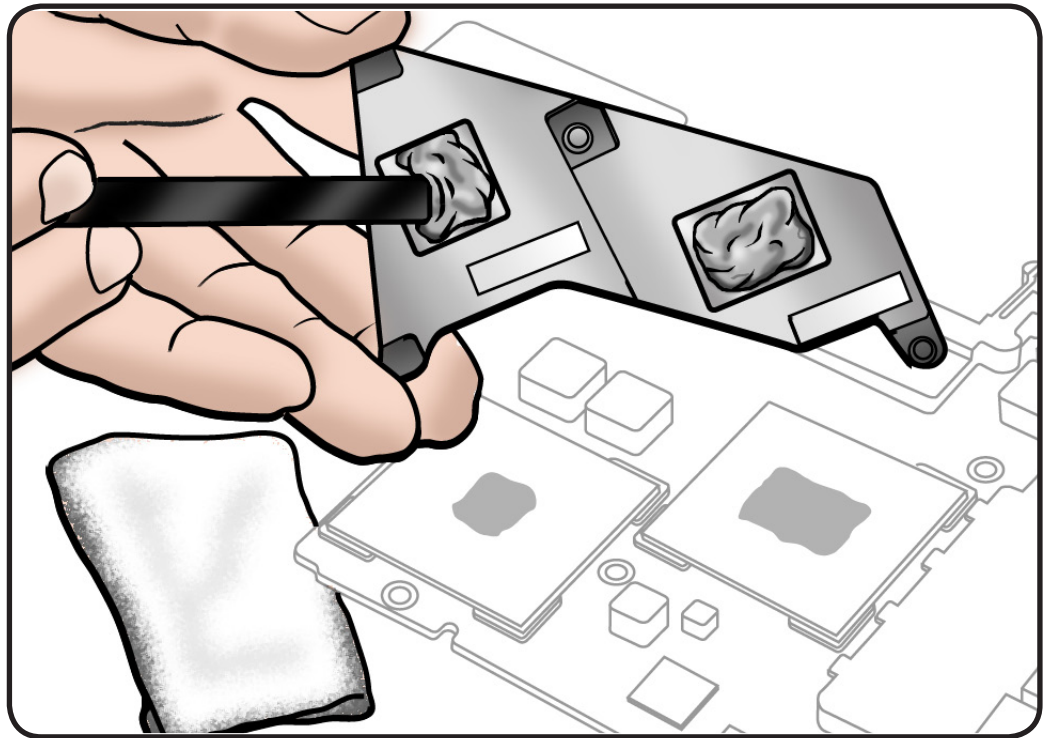
**Caution:** Do not pull heatsink

- 4 Keeping it level, lift heatsink away from board.





- 5** Scrape off thermal grease, and use alcohol pad to clean thermal pads and microprocessors.

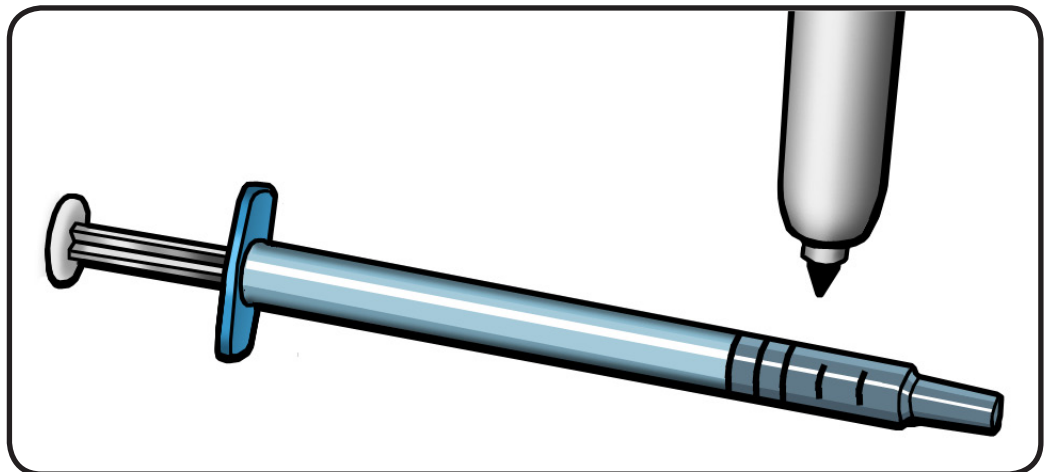


## Replacement

**Important:** New heatsinks include pre-applied thermal grease. Follow steps 1-2 only if re-installing a heatsink.

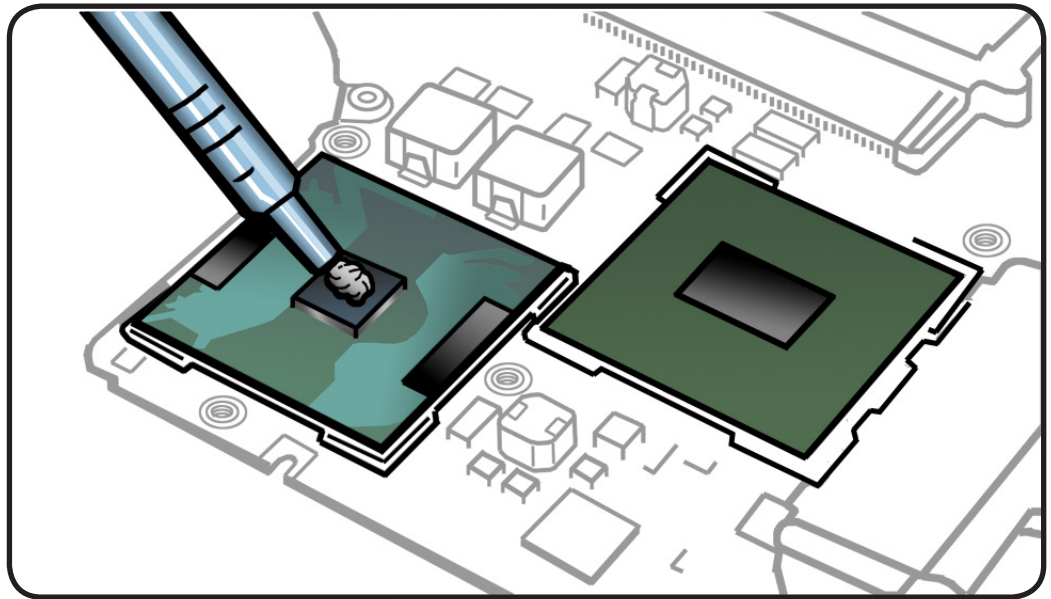
- 1 Caution:** The syringe contains enough thermal grease for 3 microprocessors. Because this computer has only 2 microprocessors, you must use only 2/3 of the syringe contents.

Use a pen to mark the syringe in thirds.



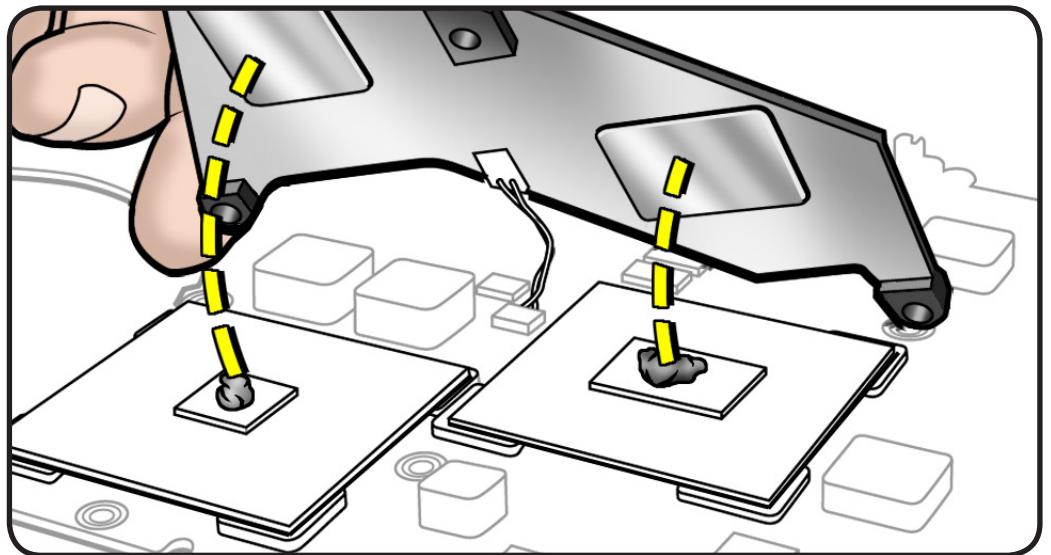


- 2 Inject 1/3 of grease on each microprocessor.



- 3 **Important:** Connect the thermal sensor.

- 4 Lower the heatsink over the logic board.







# Microphone Cable

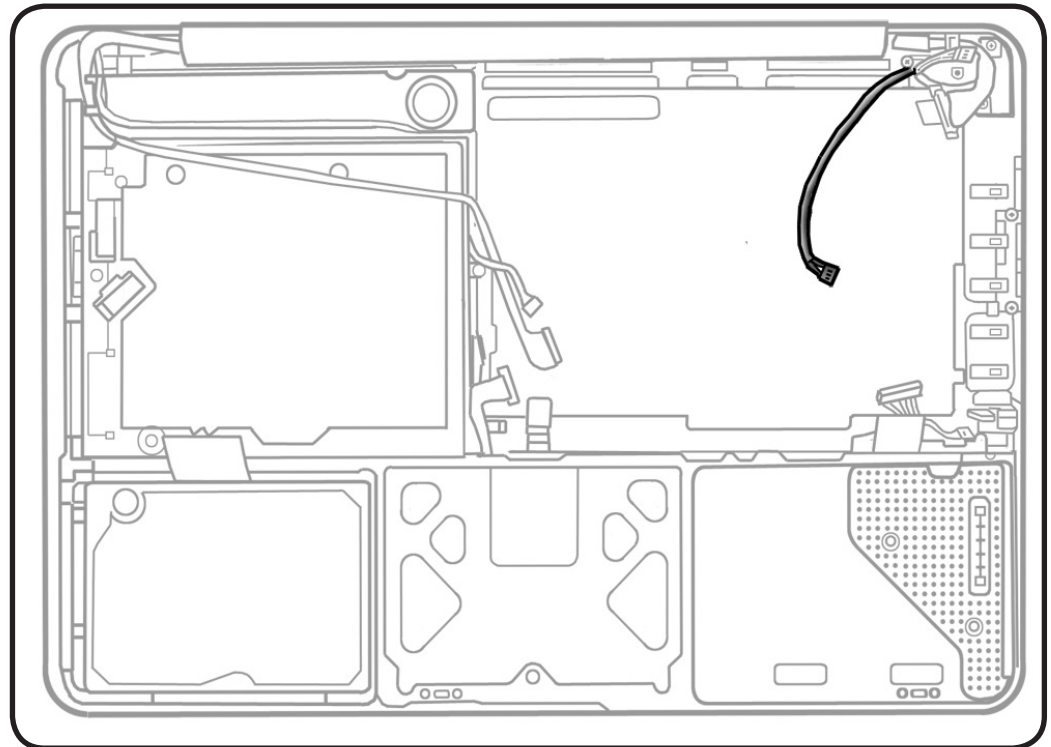
## First Steps

Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Memory](#)
- [Fan](#)
- [Keyboard flex bracket](#)
- [Logic board](#)

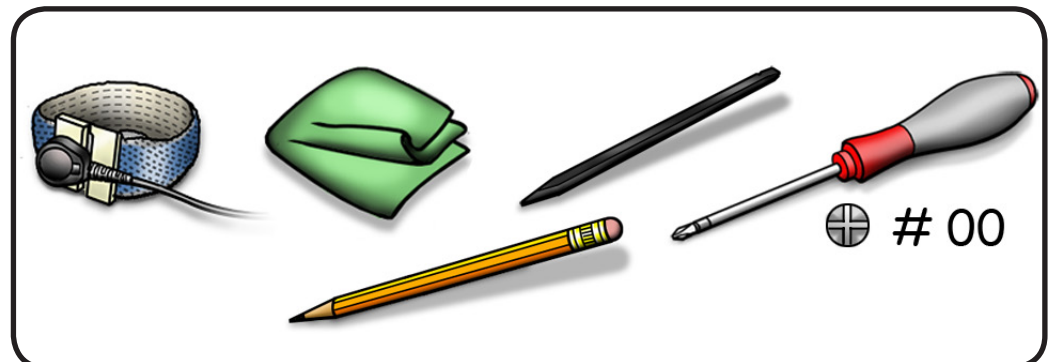


Caution: Do not strain microphone cable.



## Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetic Phillips #00 screwdriver
- Black stick
- Pencil with an eraser



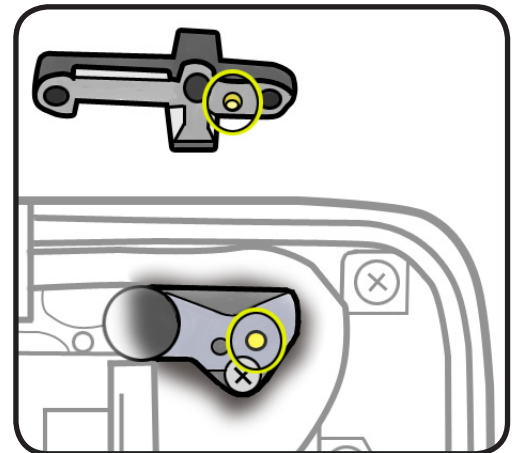
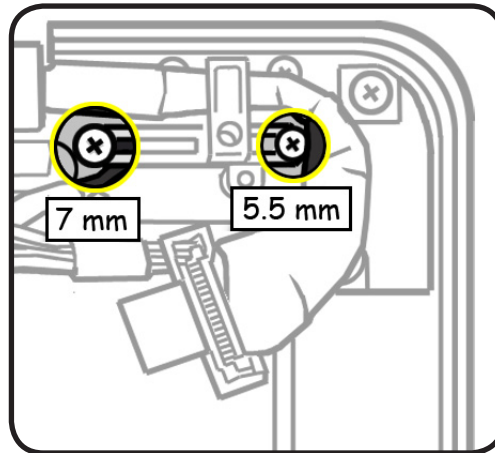


## Removal

- 1 Remove 2 screws:
  - 7 mm (922-8645)
  - 5.5 mm (922-8658)

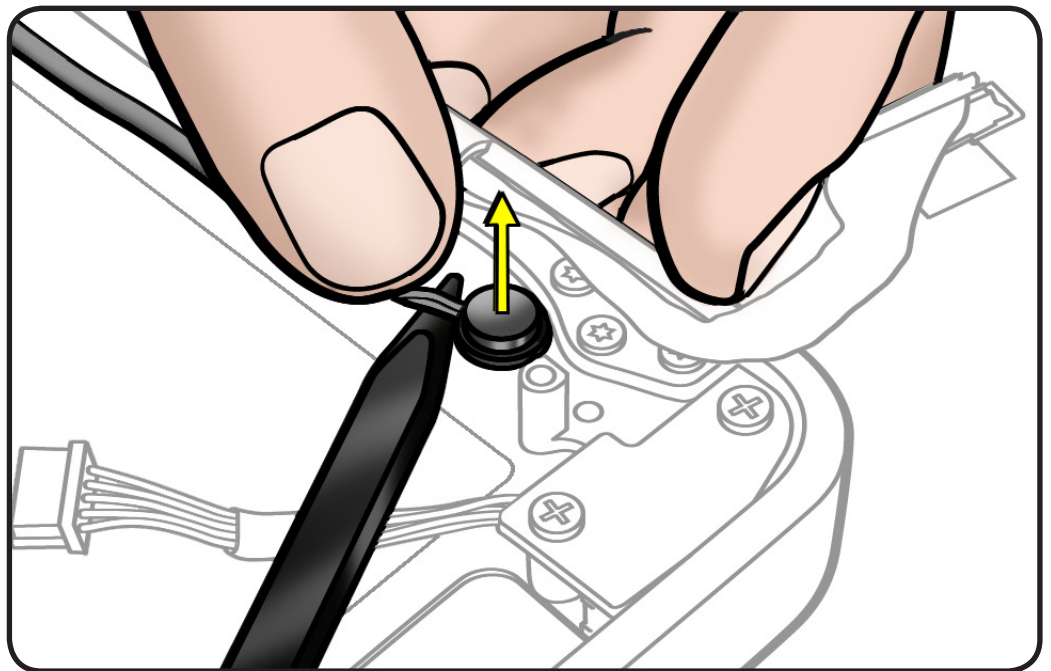
- 2 Remove LVDS cable guide.

**Replacement Note:** When installing the LVDS cable guide, seat the locator pin first.



- 3 Use black stick to pry up microphone gasket.

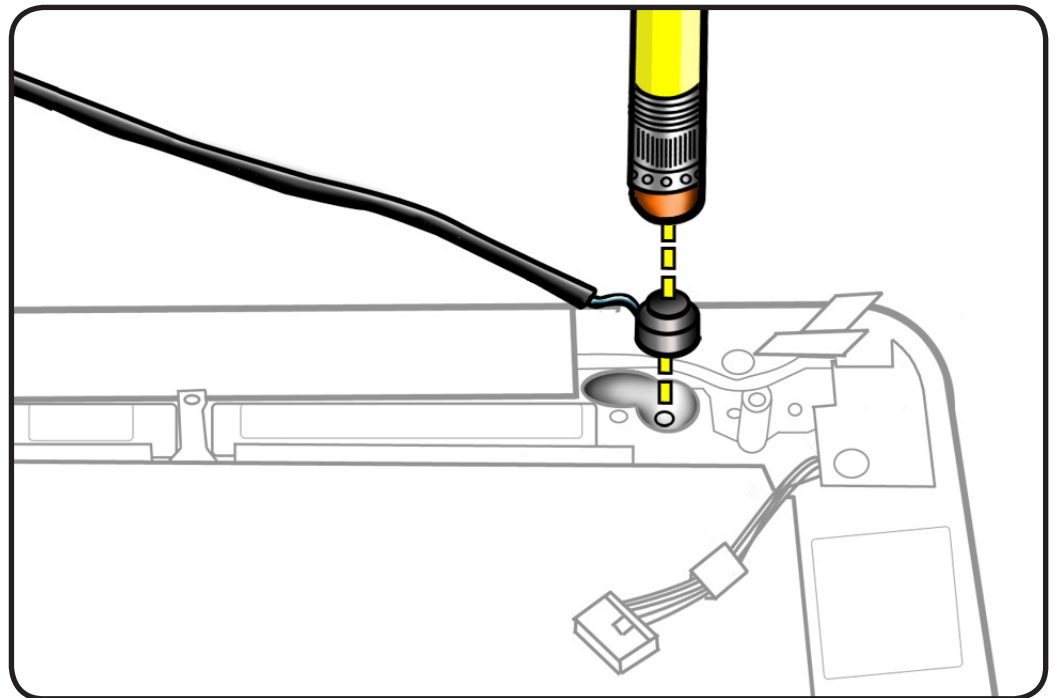
- 4 Remove any adhesive remnants from top case.





## Replacement

- 1** Remove paper backing from gasket.
- 2** Use a pencil eraser to seat the microphone gasket in the top case.
- 3** Make sure the microphone cable is not pinched when installing the LVDS cable guide.
- 4** To route the microphone cable to the board, refer to [Logic board](#).





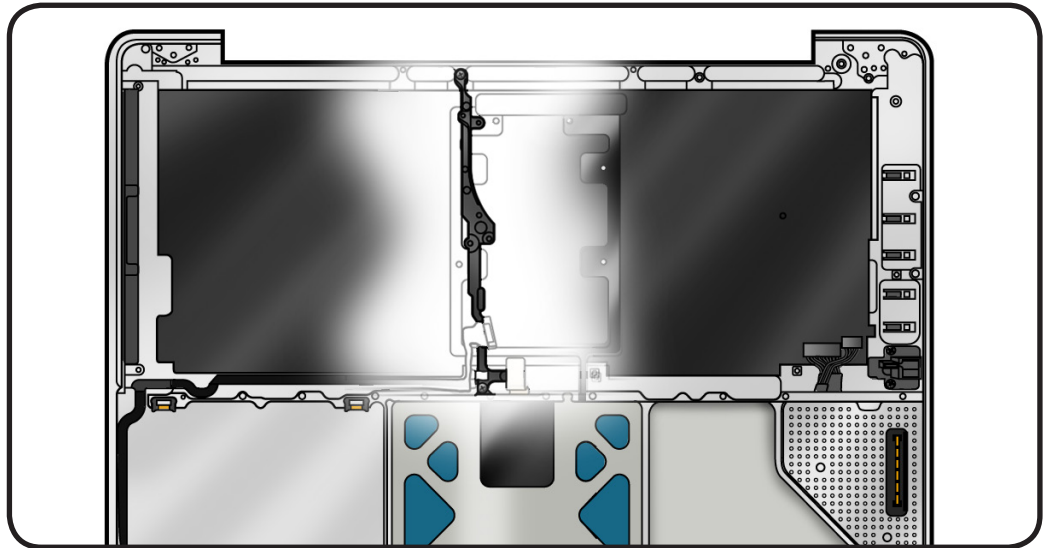


# Center Bracket

## First Steps

Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Memory](#)
- [Camera cable guide](#)
- [Optical drive](#)
- [Fan](#)
- [Keyboard flex bracket](#)
- [Logic board](#)



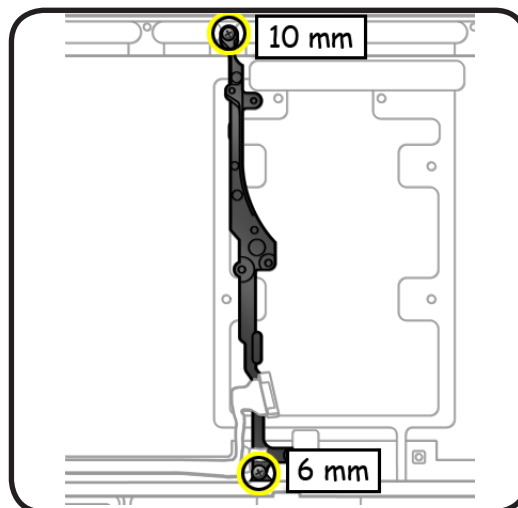
## Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetic Phillips #00 screwdriver



## Removal

- 1 Remove 2 screws:
  - 10-mm (922-8648) at top
  - 6-mm (922-8644)
- 2 Remove center bracket.



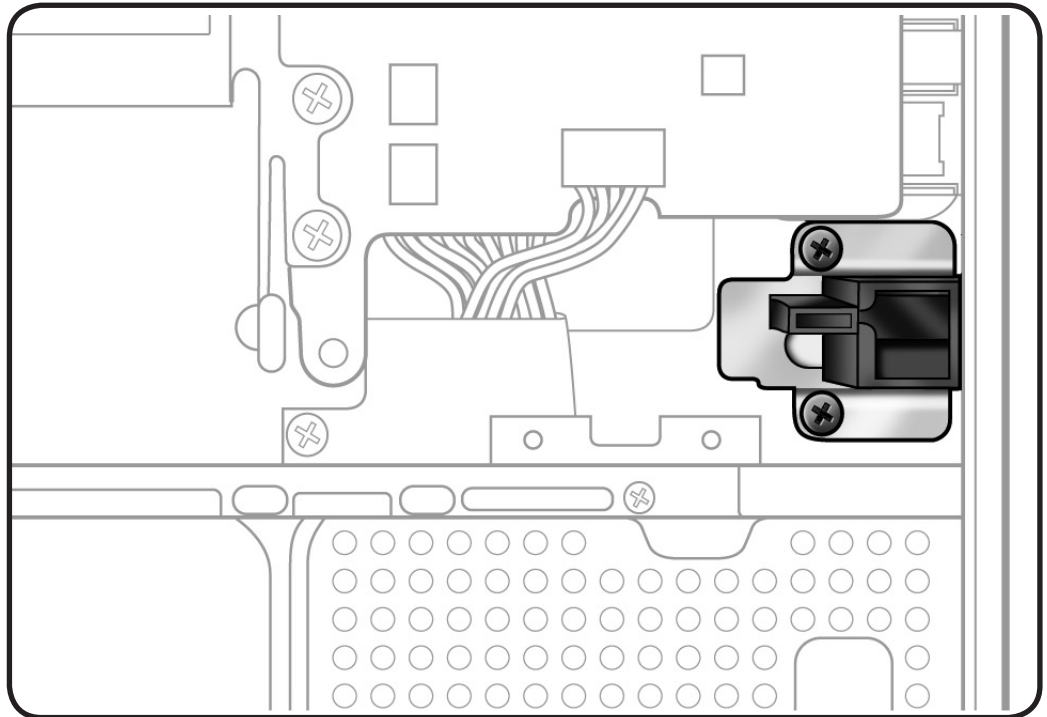


# Kensington Lock

## First Steps

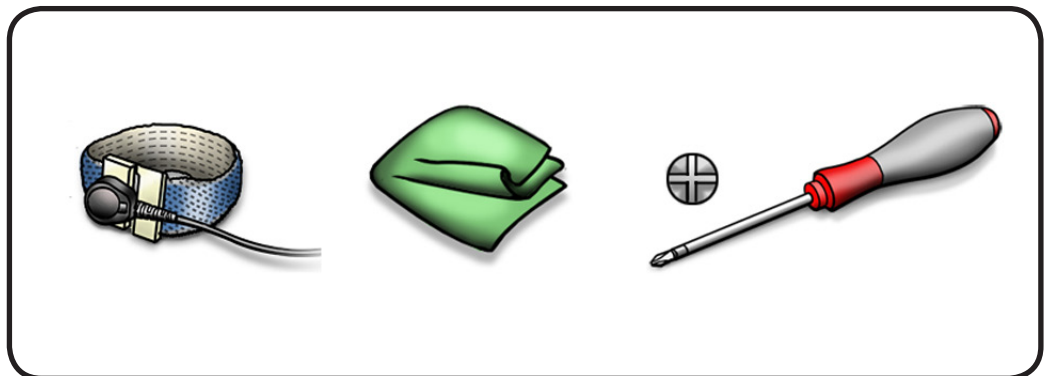
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Mid wall](#)



## Tools

- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetic Phillips #00 screwdriver



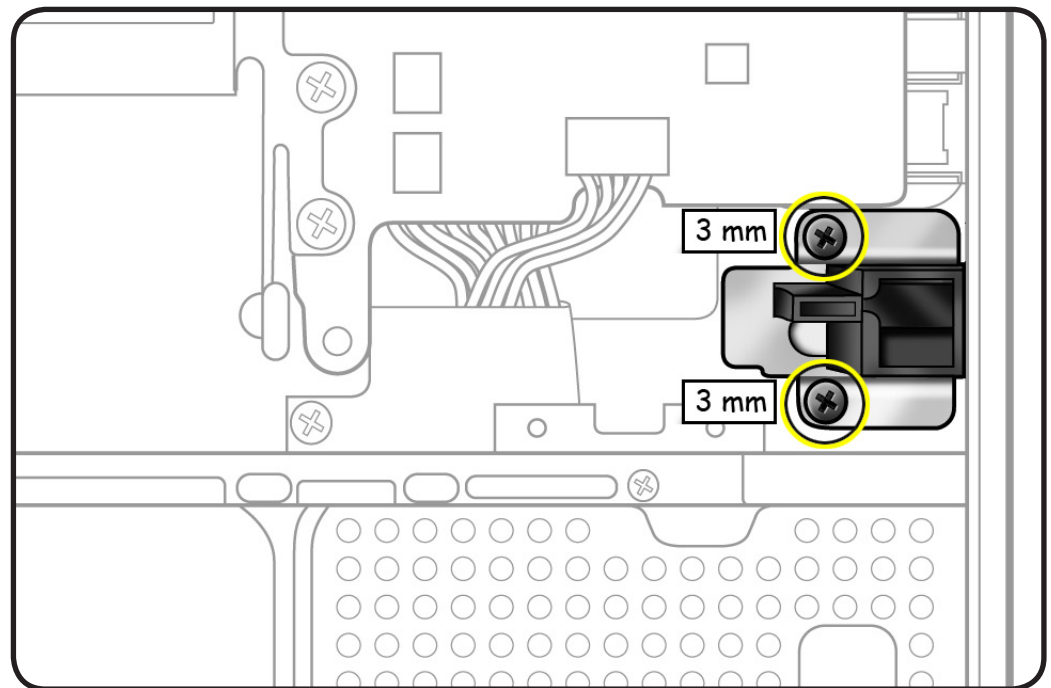


## Removal

- 1 Remove 2 (3 mm) screws (screw part number not offered).

- 2 Lift out lock.

Note that the lock includes the plastic piece and metal shield.



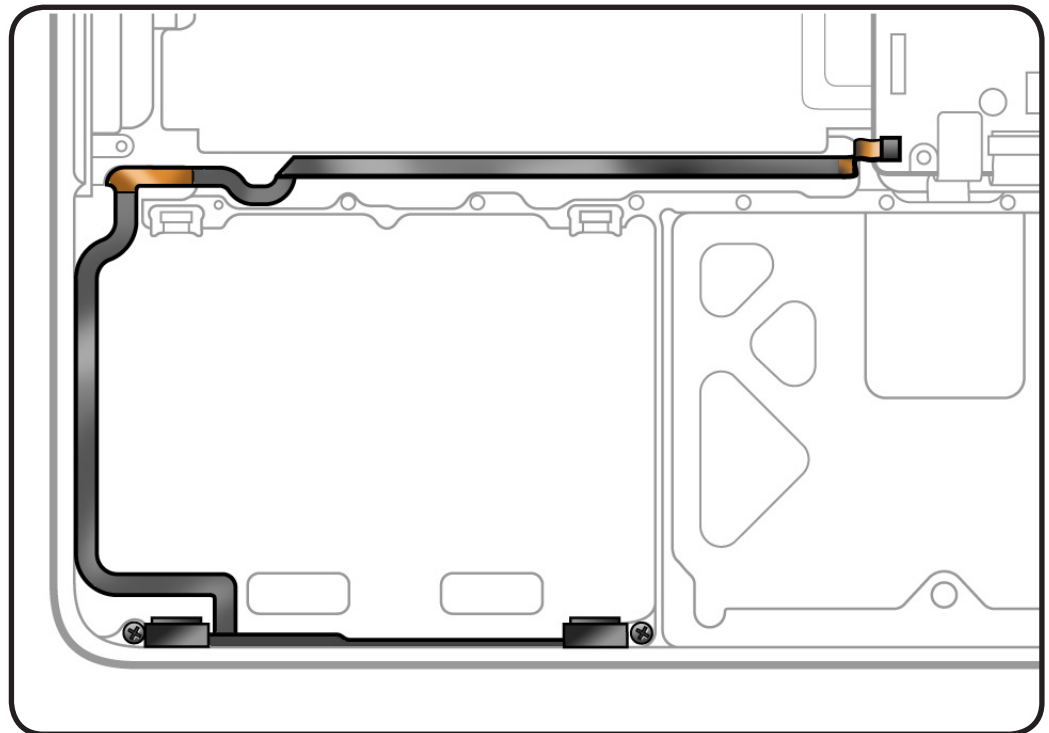


# Hard Drive Front Bracket with IR/Sleep Cable

## First Steps

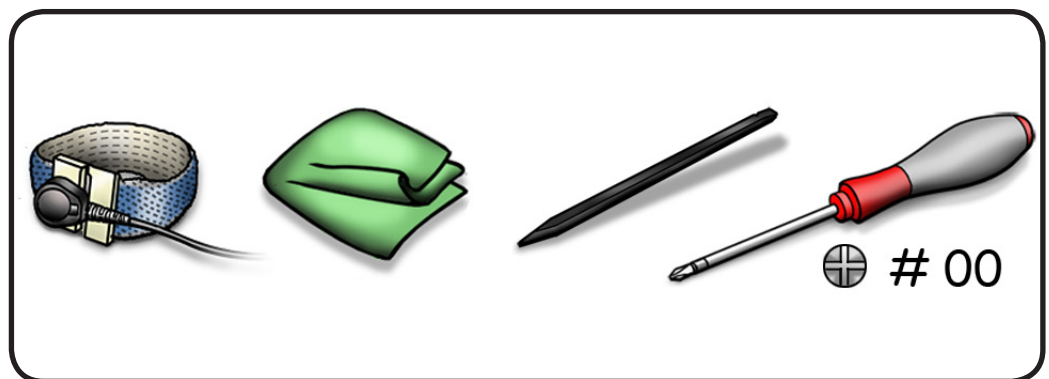
Remove:

- [Access door](#)
- [Battery](#)
- [Hard drive bracket](#)
- [Hard drive](#)
- [Bottom case](#)
- [Mid wall](#)
- [Camera cable guide](#)
- [Optical drive](#)
- [Hard drive connector cable](#)



## Tools

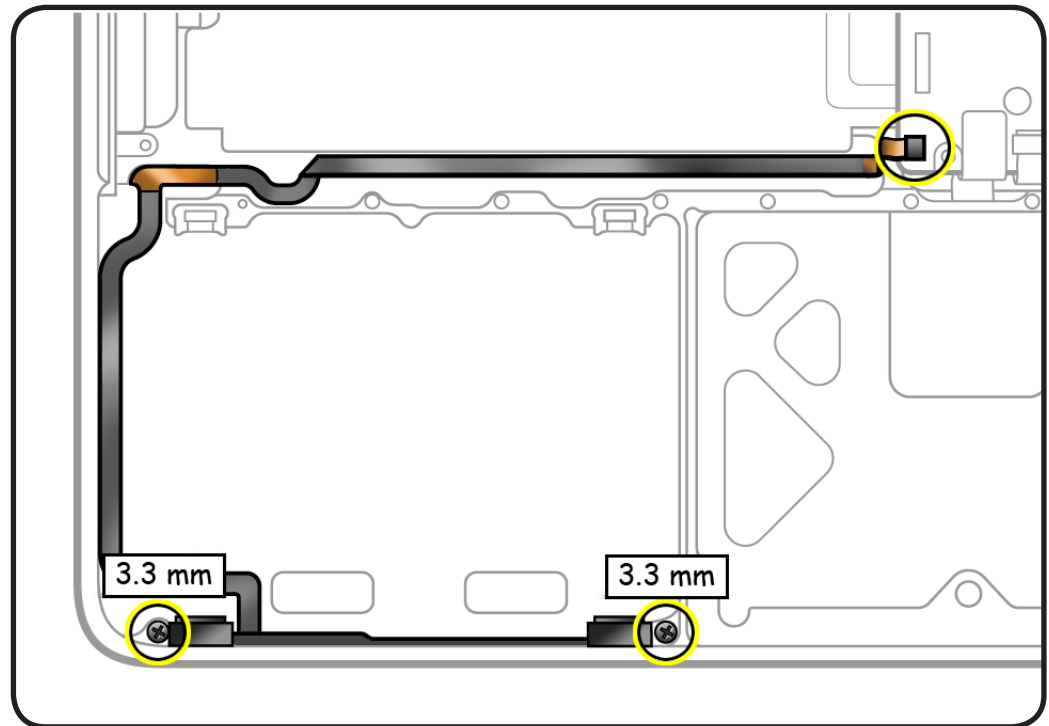
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- Magnetized Phillips #00 screwdriver
- Black stick
- Tweezers (optional)





## Removal

- 1 Note routing of IR/sleep light cable.
- 2 Remove 2 (3.3-mm) 922-8649 screws.
- 3 Tilt bracket away from top case.

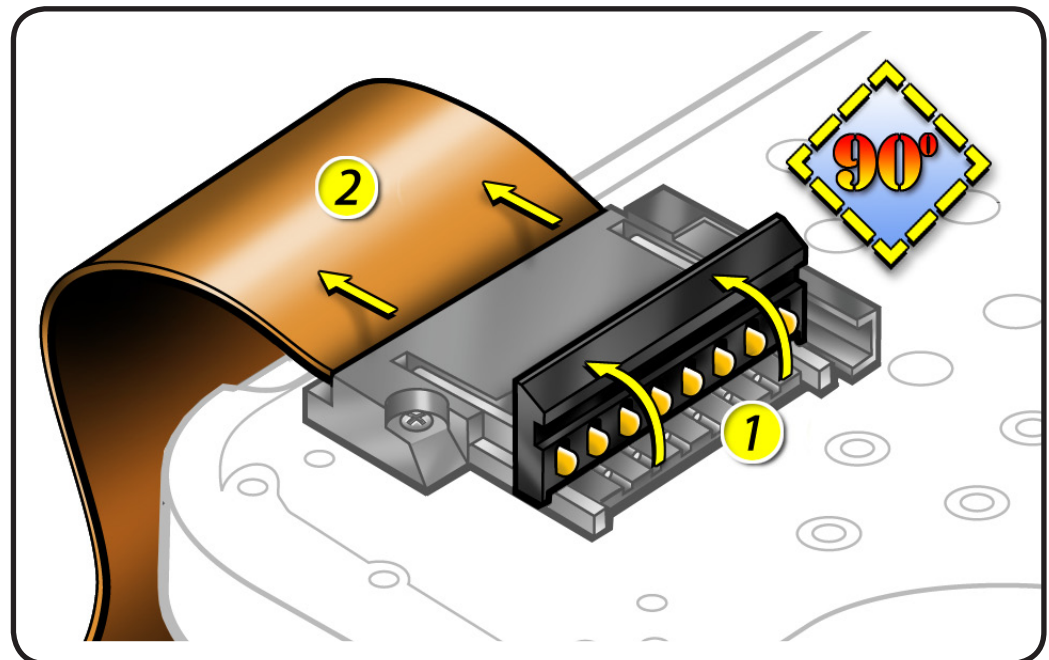


- 4 Without straining cable, disconnect IR cable connector.

- 5 Peel up cable from top case.

**Replacement Note:** Peel off adhesive backing from cable, and press cable onto top case.

**Replacement Caution:** The narrow end of the cable can be easily torn if mishandled. You may find it helpful to use two plastic tweezers to insert it into the connector. Be sure to insert it squarely to prevent an SMC short or startup issue.



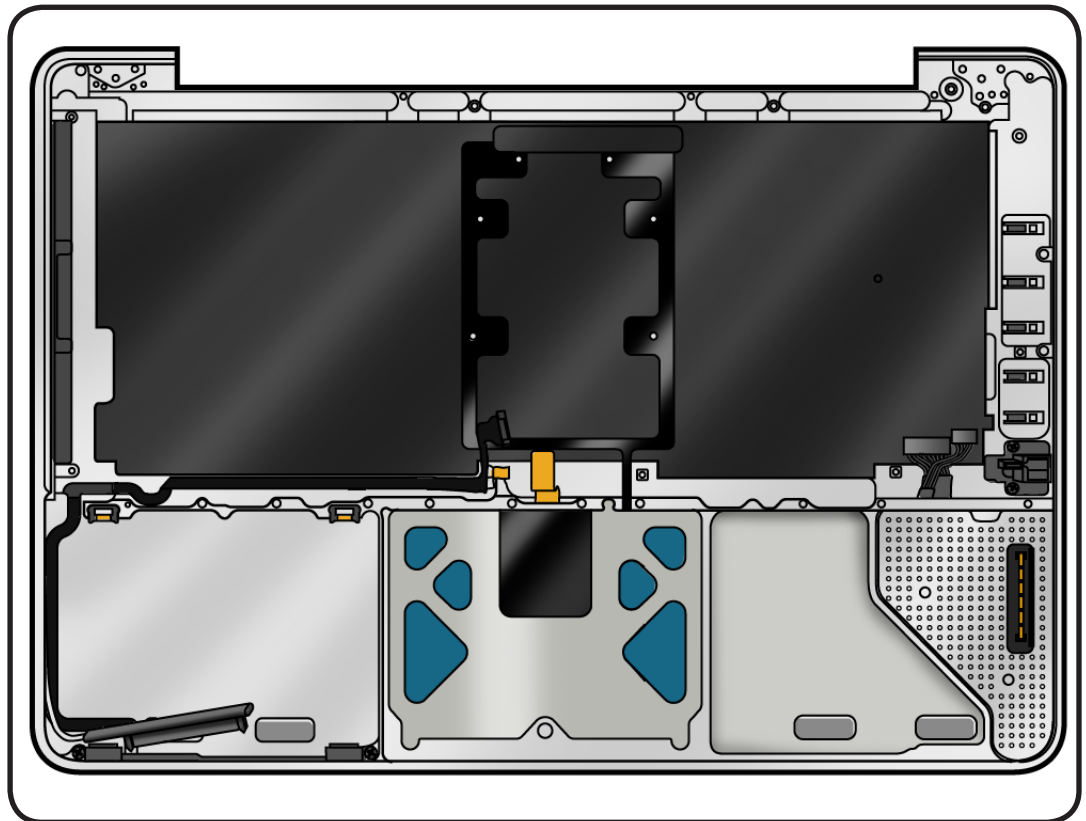


# Top Case

## First Steps

Remove:

- [Access door](#)
- [Battery](#)
- [Hard drive bracket](#)
- [Hard drive](#)
- [Bottom case](#)
- [Memory](#)
- [Mid wall](#)
- [Battery cable guide](#)
- [Camera cable guide](#)
- [LVDS cable guide](#)
- [Display assembly](#)
- [Optical drive](#)
- [Right speaker/ subwoofer](#)
- [Fan](#)
- [Keyboard flex bracket](#)
- [Logic board](#)
- [Microphone cable](#)
- [MagSafe board](#)
- [Center bracket](#)



## Tools

No tools are required for this procedure.

## Removal

With the first steps completed, the top case is the remaining part.

The top case includes:

- battery indicator light board and cable



- battery power cable
- battery connector cover
- hard drive connector cable
- hard drive front bracket with IR/sleep cable
- Kensington lock

**Replacement Note:**

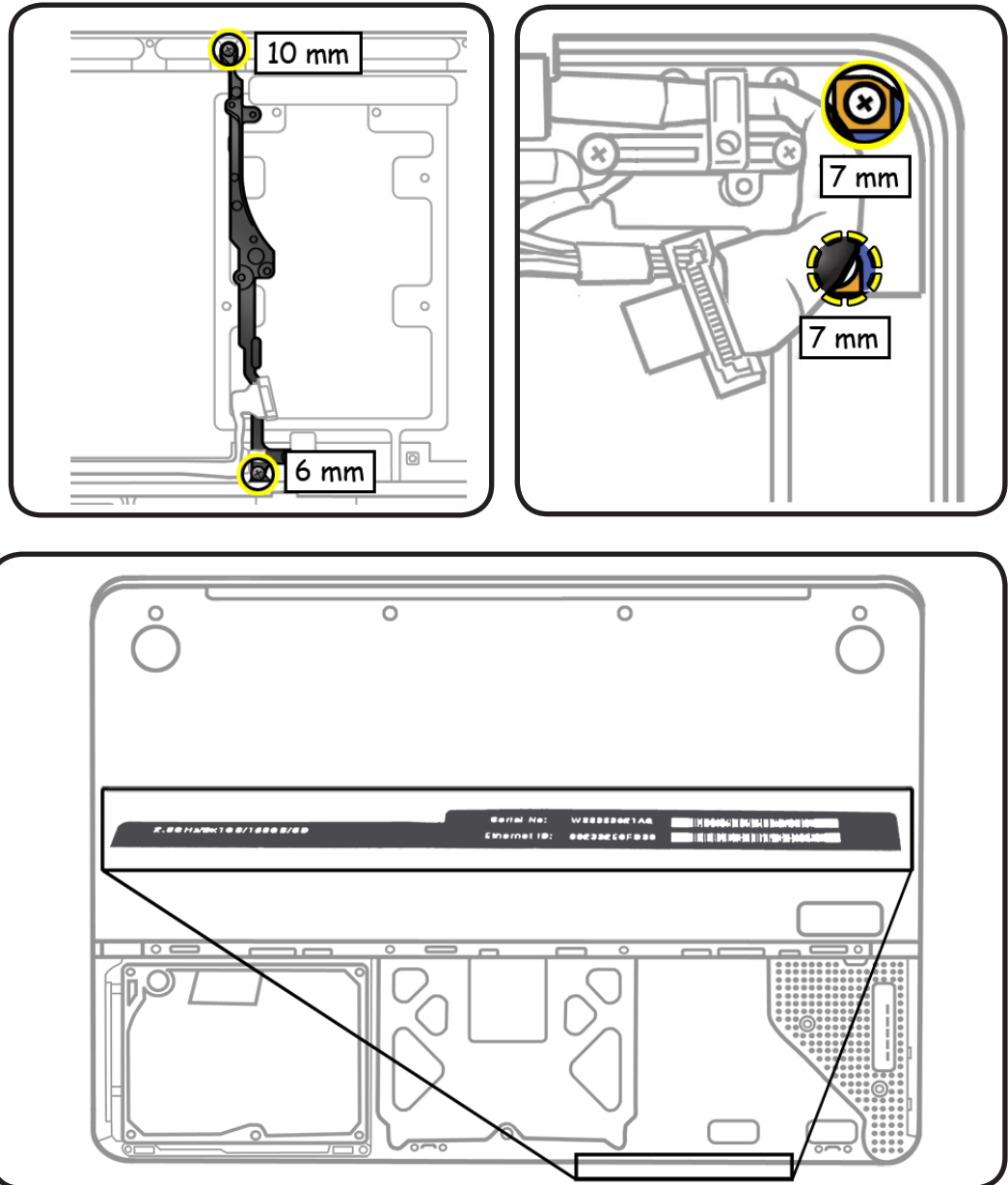
Before assembling the computer, be sure to first transfer the following parts to the new top case:

- [Center bracket](#)
- [MagSafe board](#)



**Replacement Note:**

When replacing a top case, retain the customer's top case until the repair is complete. Before installing the replacement top case, peel up the serial number label from the original top case and transfer it to the replacement.



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# **Apple Technician Guide**

## **Additional Procedures**

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### **MacBook (13-inch, Aluminum, Late 2008)**





# Hinge Replacement and Alignment

## Overview

Storing the computer upright on the hinge edge can result in the display inadvertently opening. To prevent further occurrences, follow this procedure to replace and align the hinges.

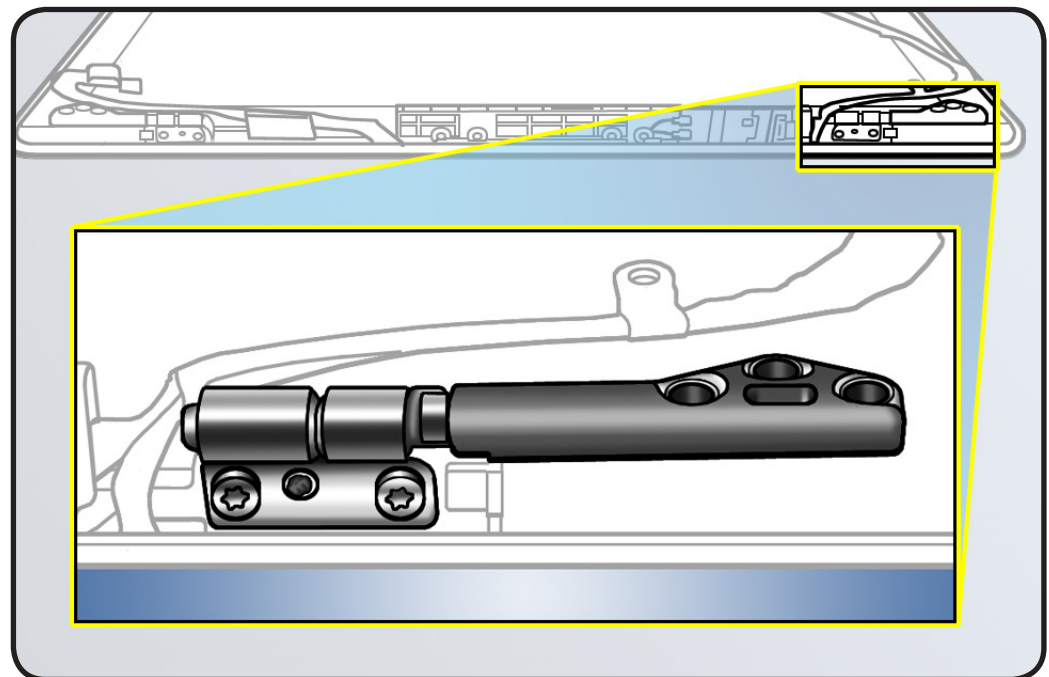
When replacing hinges, make sure they are properly aligned to minimize any gaps where the display housing mounts to the top case.

## First Steps

Order hinge alignment kit (Apple part # 076-1357) that includes one set of the left and right hinges.

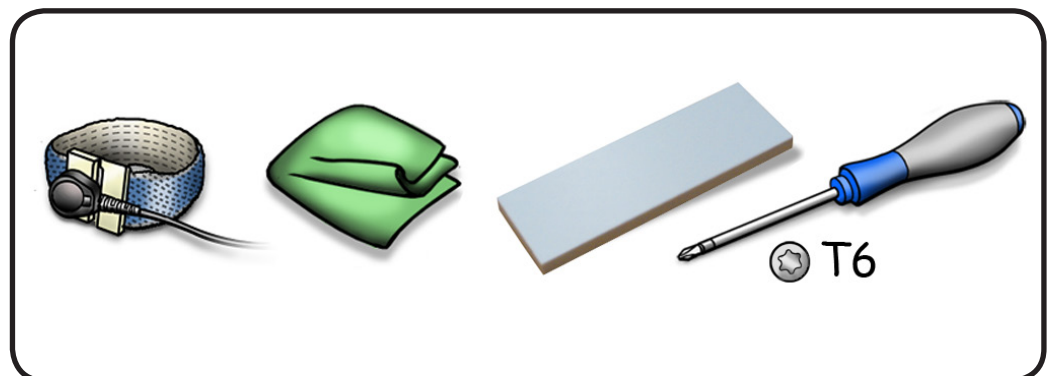
Remove:

- [Access door](#)
- [Battery](#)
- [Bottom case](#)
- [Camera cable guide](#)
- [LVDS cable guide](#)
- [Display assembly](#)
- [Display clutch cover](#)



## Tools

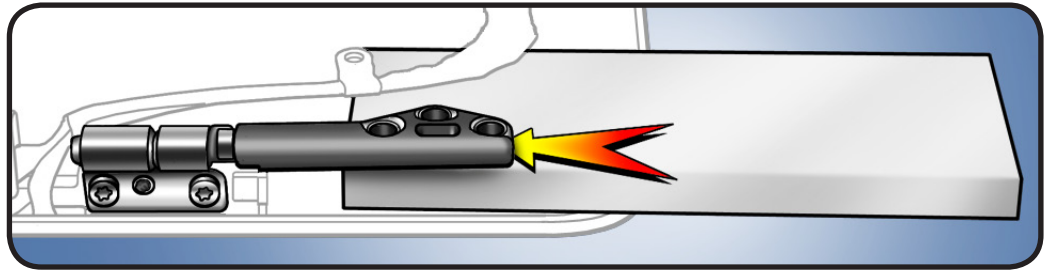
- Clean, soft, lint-free cloth
- ESD wrist strap and mat
- plastic alignment guide (Apple part # 922-9272)
- Torx T6 screwdriver





## Procedure

- 1 Insert alignment guide between flat bottom of hinge and raised black trim on display clamshell.

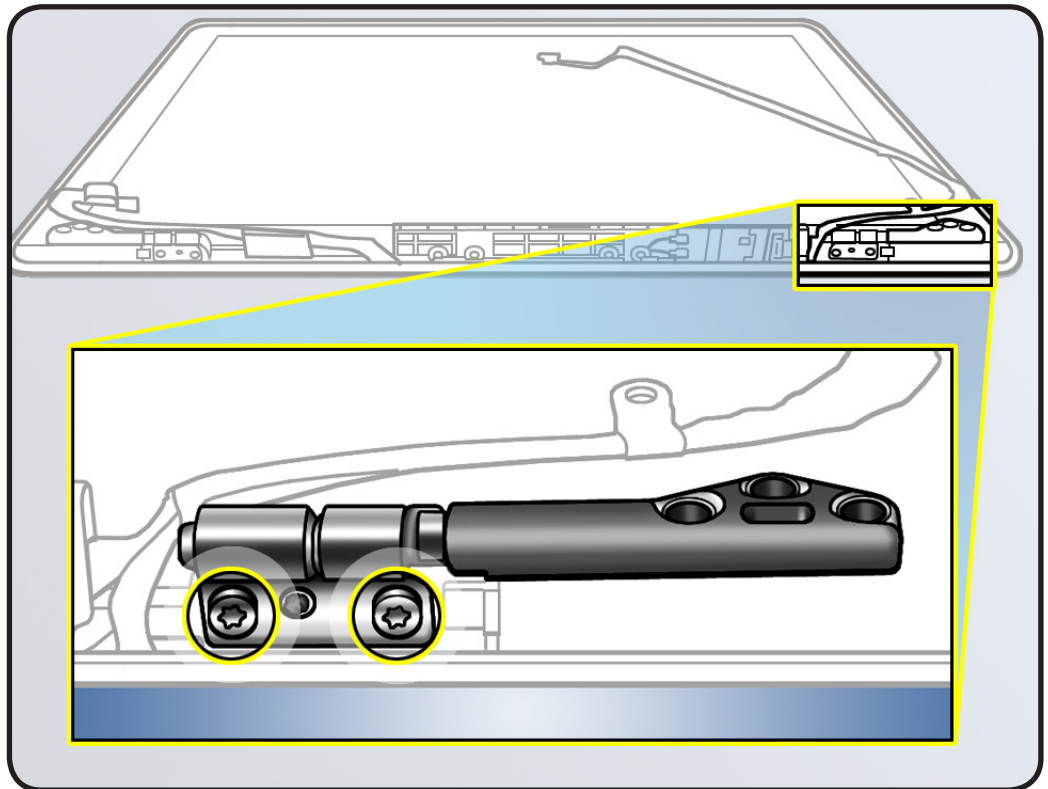


- 2 If gap between hinge and trim is out of tolerance, adjust clutch by removing 2 T6 mounting screws.

- 3 Move clutch slightly until gap is 5.7mm +/- 0.1mm, the same height as the alignment guide.

- 4 Reinstall 2 screws, and reassemble computer.

- 5 Verify that display opens and closes completely and there are no gaps between top case and display housing.



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# **Apple Technician Guide**

## **Views**

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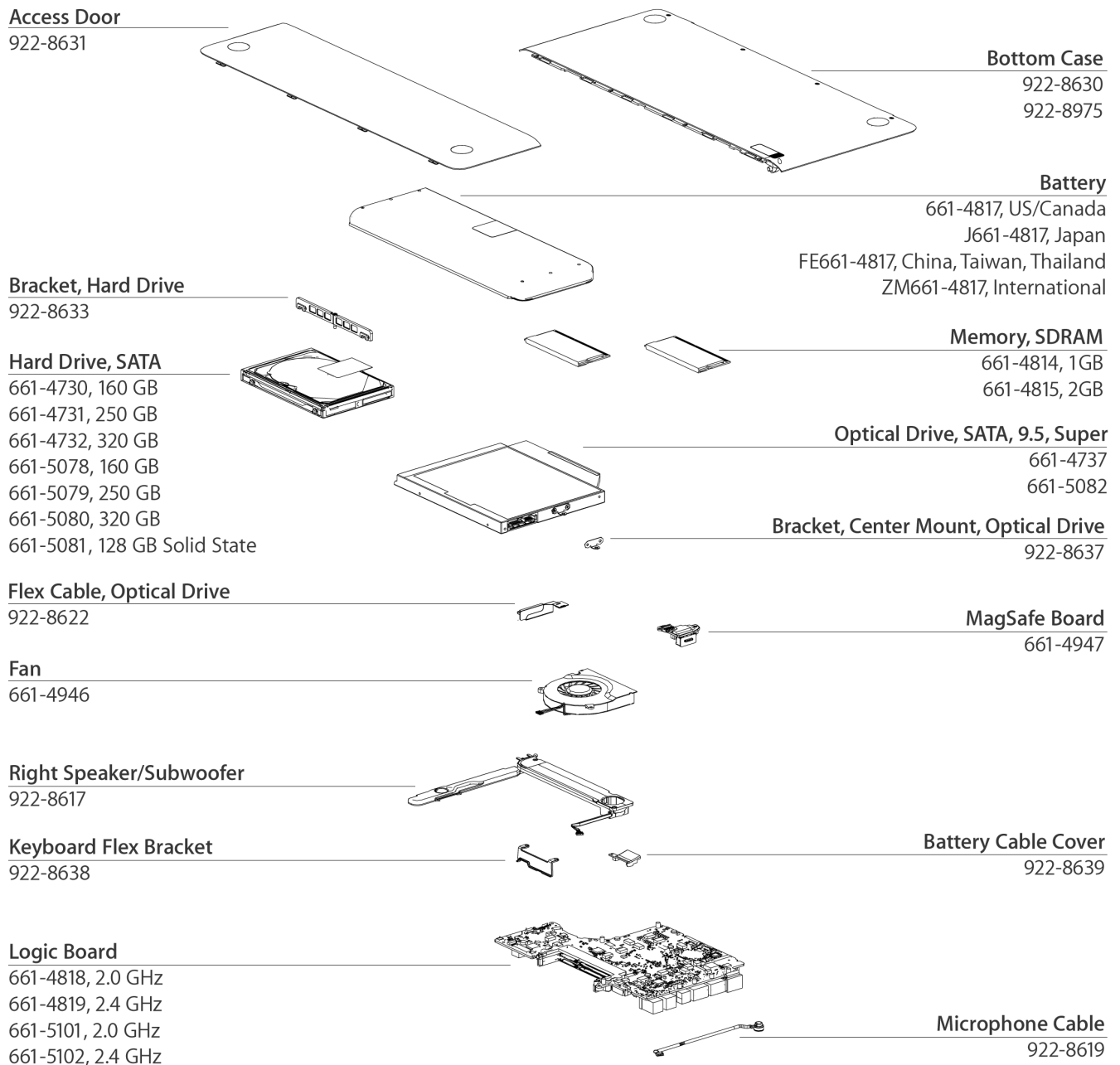
### **MacBook (13-inch, Aluminum, Late 2008)**



# Exploded Views

## Main Assembly, 1 of 2

**Important:** Replace parts like-for-like. For parts with more than one part number, enter the product serial number in GSX to determine the compatible part.



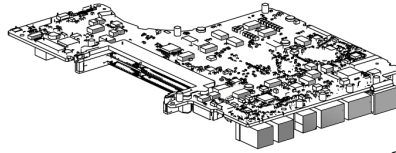


## Main Assembly, 2 of 2

**Important:** Replace parts like-for-like. For parts with more than one part number, enter the product serial number in GSX to determine the compatible part.

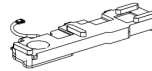
### Logic Board

661-4818, 2.0 GHz  
661-4819, 2.4 GHz  
661-5101, 2.0 GHz  
661-5102, 2.4 GHz



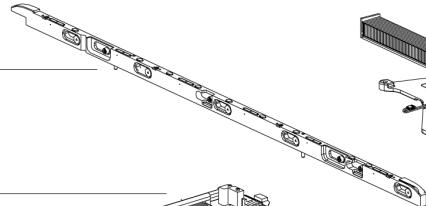
### Left Speaker

922-8618



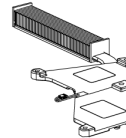
### Mid Wall

922-8632  
922-8976



### Heatsink

661-4945



### Hard Drive Connector Cable

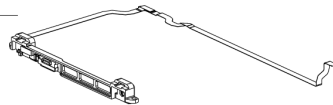
922-8623



### Front Hard Drive

#### Bracket with IR/Sleep

922-8783



### Kensington Lock

922-8786



### Cover, Battery Connector

922-8641



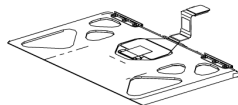
### Battery Power Cable

922-8625



### Trackpad

922-9014



### Battery Indicator Cable

922-8624



### Button, Battery Indicator

922-8792



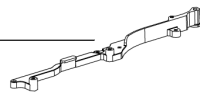
### Battery Indicator Board

922-8727



### Center Bracket

922-8634



### Camera Cable Guide

922-8636

922-8979



### LVDS Cable Guide

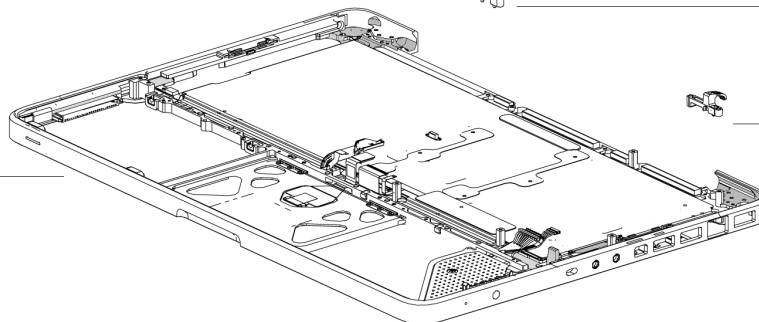
922-8635

922-8978



### Top Case with Keyboard

661-4943, non-backlit, US  
661-4944, backlit-US





## Display Assembly

**Important:** Replace parts like-for-like. For parts with more than one part number, enter the product serial number in GSX to determine the compatible part.

**Clip, AirPort Antenna**  
076-1326

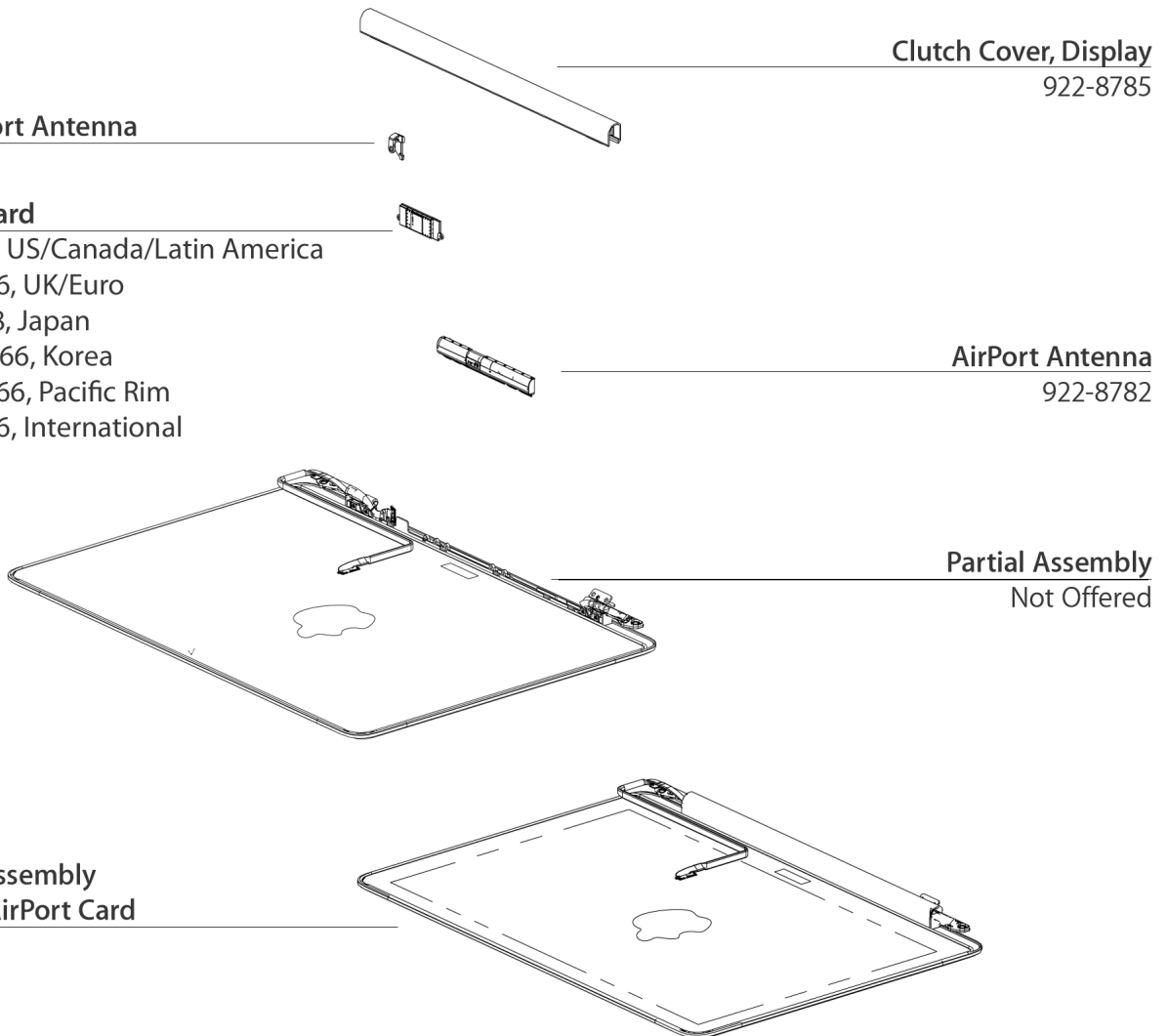
**AirPort Card**  
661-4766, US/Canada/Latin America  
B661-4766, UK/Euro  
J661-4788, Japan  
KH661-4766, Korea  
PA661-4766, Pacific Rim  
Z661-4766, International

**Clutch Cover, Display**  
922-8785

**AirPort Antenna**  
922-8782

**Partial Assembly**  
Not Offered

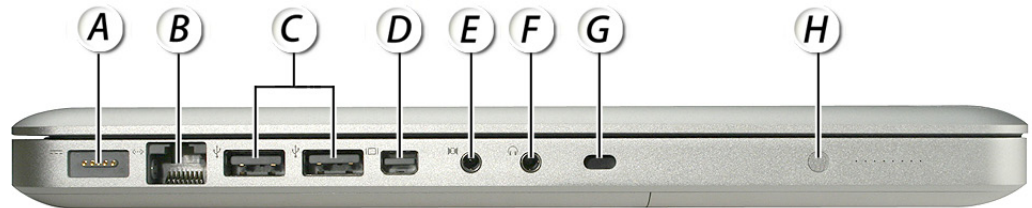
**Display Assembly  
without AirPort Card**  
661-4820  
661-5103





# External Views

## Port View



**A = MagSafe Power**

**B = Gigabit Ethernet**

**C = USB 2.0 (1 high powered)**

**D = Mini DisplayPort**

**E = Combo Digital/Analog Audio In**

**F = Combo Digital/Analog Audio Out**

**G = Security Slot**

**H = Battery Indicator Light Button**



# Screw Chart

<b>076-1320</b> Phillips #00   Included in Logic Board Kit	<b>076-1326</b> Phillips #00   Included in AirPort Card Kit: antenna (4), card (2), cable clip (1)	<b>922-8642</b> Spring   Heatsink springs (4)
<b>922-8644</b> Phillips #00   Center bracket, fan, optical drive, keyboard flex bracket	<b>922-8645</b> Phillips #00   Fan, LVDS cable guide, MagSafe board	<b>922-8648</b> Phillips #00   Center bracket (top)
<b>922-8649 / 922-8973</b> Phillips #00   Hard drive front bracket	<b>922-8650 / 922-8974</b> Phillips #00   Camera cable guide, right speaker	<b>922-8651</b> Phillips #00   Battery connector cover (2)
<b>922-8652</b> Phillips #00   Battery connector cover (1)	<b>922-8653</b> Phillips #00   Bottom case to mid wall	<b>922-8654</b> Phillips #00 shoulder   Logic board (1)



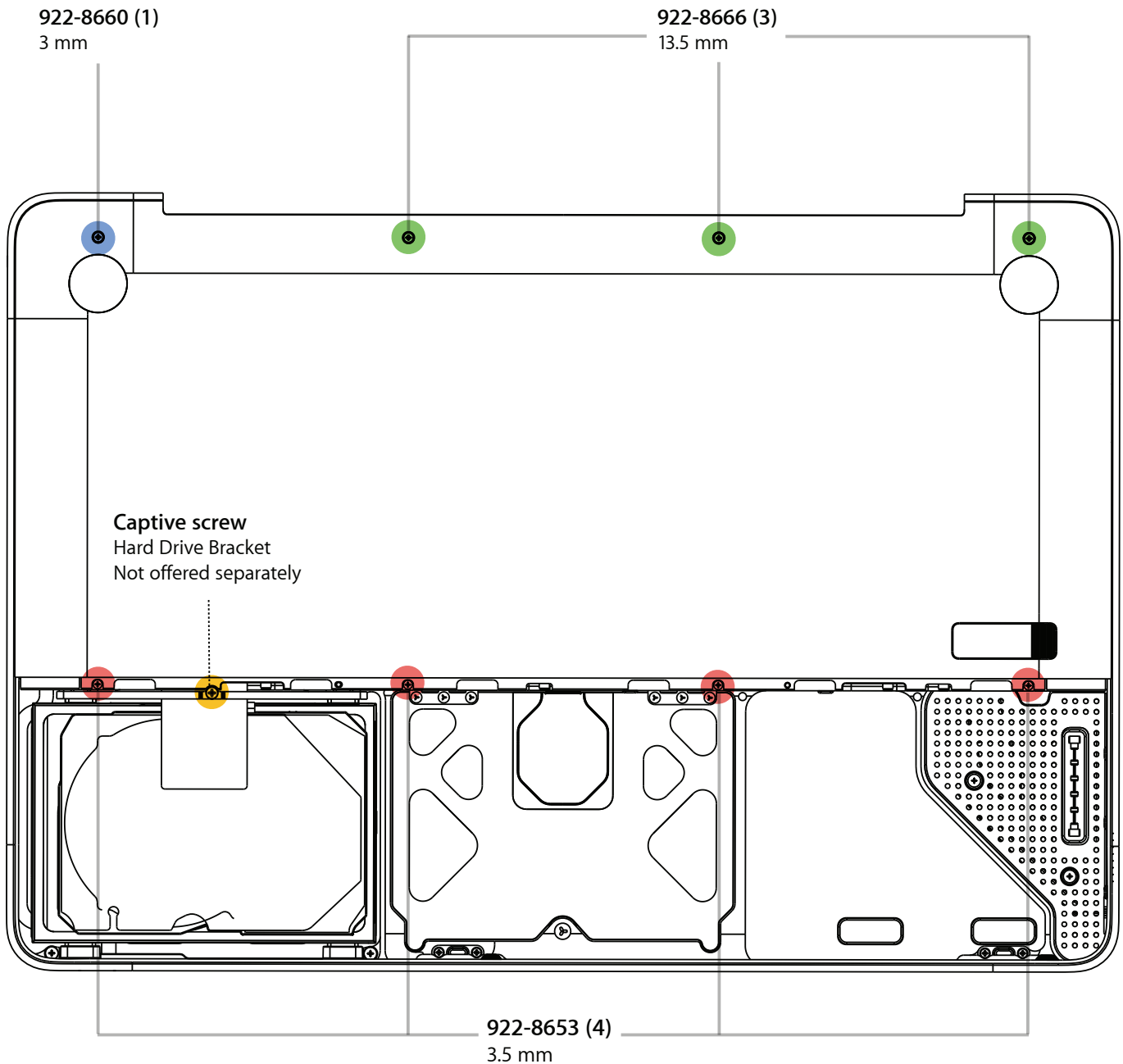


<b>922-8655</b> Torx T6  Hard drive	<b>922-8656</b> Phillips #00  Mid wall	<b>922-8657</b> Phillips #00  Battery indicator light (BIL) board
<b>922-8658</b> Phillips #00  LVDS cable guide	<b>922-8660 / 922-8972</b> Phillips #00  Bottom case to top case (1)	<b>922-8661</b> Phillips #00  Battery cable guide
<b>922-8662</b> Phillips #00  Optical drive	<b>922-8663</b> Phillips #00  Logic board (4)	<b>922-8665 / 922-8971</b> Phillips #00  Camera cable guide
<b>922-8666</b> Phillips #00  Bottom case to top case (3)	<b>922-8692</b> Phillips #0 or #1  Heatsink (4)	<b>922-8756 / 922-8970</b> Torx T6  Display assembly hinges



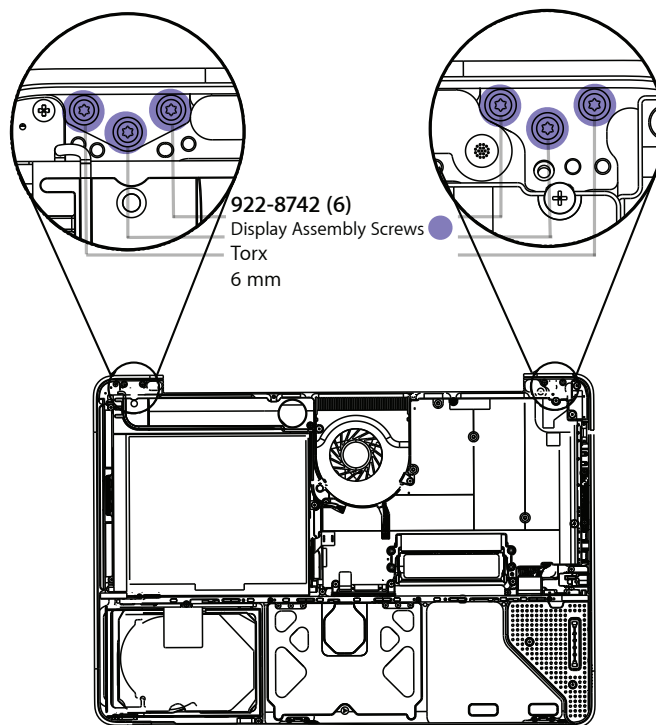
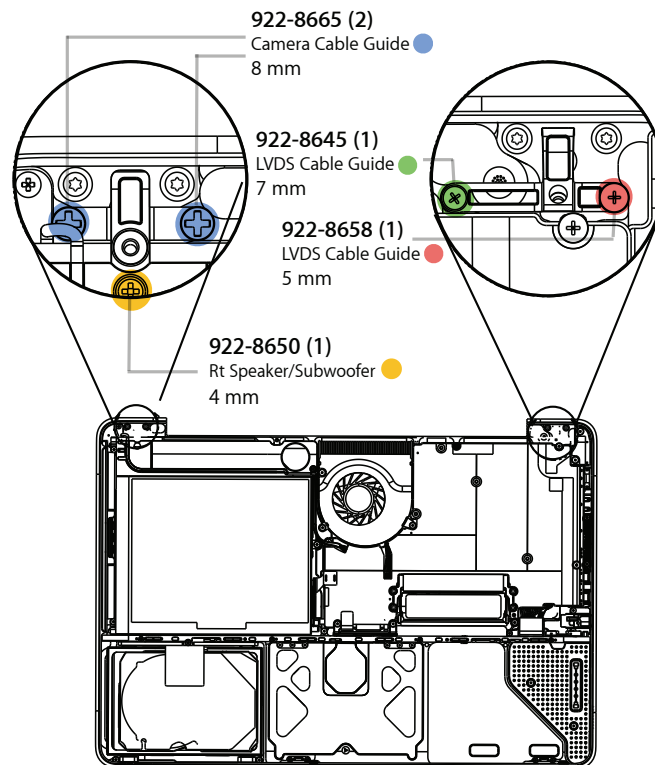
# Screw Location Diagrams

## Bottom Case





## Display Assembly





## Top Case

